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COMPETITION FOR ADVERTISERS AND FOR VIEWERS IN MEDIA MARKETS

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Abstract

Standard models of advertising-financed media assume consumers patronize a single media platform, precluding effective competition for advertisers. Such competition ensues if consumers multi-home. The principle of incremental pricing implies that multi-homing consumers are less valuable to platforms. Then entry of new platforms decreases ad prices, while a merger increases them, and ad-financed platforms may suffer if a public broadcaster carries ads. Platforms may bias content against multi-homing consumers, especially if consumers highly value overlapping content and/or second impressions have low value.

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1 Introduction

Standard media economics models (e.g. Anderson and Coate, 2005, and many subsequent papers) restrict media consumers to attend at most a single media platform. That is, they watch just one TV channel, listen to just one radio station, surf only one web-site, or read only one magazine or newspaper. This is termed "single-homing" in the two-sided markets literature. Advertisers place ads on all platforms (they "multi-home"), but are cornered by the fact that each platform has exclusive market power in delivering its own consumers. This is the "competitive bottleneck" problem of Armstrong (2002, 2006).

The intent of this paper is to investigate the consequences of relaxing the assumption of single-homing media consumers in the performance of media markets, and we demonstrate that some puzzles in the received wisdom on media economics can be resolved by allowing for multi-homing consumers.

The assumption of single-homing consumers is questionable. Even in traditional media markets (such as TV) a non-negligible and increasing fraction of consumers multi-home. Gentzkow, Shapiro, and Sinkinson (2014) use data on US newspapers from the early 20th century, and they find that multiple readership is quantitatively important. In their data, 15% of the households that read newspapers daily, read two or more newspapers. Due to the growth of the Internet and online ad-financed platforms, multi-homing has become much more widespread (Athey, Calvano and Gans, 2014, Peitz and Reisinger, 2015). This also means that consumers are exposed to ads from multiple sources.

Importantly, the competitive bottleneck problem partly disappears if a fraction of the consumers multi-home. This is because an ad on a platform then enables the advertiser to access not only consumers who are exclusively on that platform, but also consumers shared with other platforms. We develop and invoke the "principle of incremental pricing": each platform is able to price to advertisers only the value of its exclusive consumers plus the *incremental value* associated to multi-homing (shared) consumers.[1] Multi-homing consumers are typically less valuable than single-homing consumers are for platforms, and the incremental pricing principle holds independent of whether consumers like or dislike ads. Peitz and Reisinger (2015) nicely illustrate why single-homing consumers might be a reasonable assumption for traditional TV; if an advertiser can choose the broadcasting time for its ads, it will choose the same time slot on each channel. Thereby the advertiser avoids paying for reaching one and the same consumer more than once. Effectively, we then have single-homing consumers from the advertiser's point of view. However, with non-linear TV (e.g. streaming) such a strategy would not work, since the viewers can decide on their own when to watch the programs they are interested in. Along with the growth of non-linear TV, it thus becomes increasingly important to allow for multi-homing consumers.

Due to their assumption of single-homing consumers and ad nuisance, standard media economics models predict that profits for ad-financed platforms increase if public broadcasters are allowed to air ads, that mergers reduce ad prices, and that each platform will charge higher ad prices per consumer if new platforms enter the

[1] Spence (1976) makes a similar point for (perfectly) price-discriminating producers of differentiated products. The incremental pricing principle leaves surplus on the table for advertisers when benefits are sub-additive across platforms.

market.[2]

We show that these predictions are reversed when allowing for multi-homing consumers: ad-financed platforms may then suffer when a public broadcaster carries ads, a merger increases ad prices, while platform entry decreases ad prices. This is more consistent with what we observe. It sheds light on why ad-financed platforms typically complain if a public broadcaster is allowed to air ads, and why competition authorities are concerned about the effect on advertisers from a merger between platforms.

We also analyze how the principle of incremental pricing and multi-homing affect platforms' choice of genre. To do this we specify a formal spatial model a la Hotelling (1929) with a continuum of genres. Strikingly, and in contrast to both Steiner (1952) and standard Hotelling frameworks under single-homing consumers, we show that a two-platform monopoly and competition give the same choices. Specifically, if only the first impression has any value, the platforms will locate at each end of the Hotelling line even if they do not compete in prices (neither directly nor indirectly). With valuable second impressions, the two-genre monopoly solution moves closer to the middle to pick up now-valuable multi-homing consumers. The neutrality-to-market-structure result prevails: a two-platform monopoly and competition give the same locations. A merger will thus not affect genre diversity, but equilibrium genre choices are too extreme compared to social optimum if second impressions are not worth

[2]These results follow because competition is effectively for media consumers, given the competitive bottleneck, and the "price" to consumers is ad nuisance. Then ad levels follow the predictions of standard differentiated substitutes models for product prices. Results for ad prices follow from the inverse relation between advertiser demand price per consumer and advertising level. These results reverse if ads are instead a benefit to consumers. There is no effect if consumers are ad-neutral. See e.g. Anderson, Foros, Kind and Peitz (2012), who provide an informal discussion of the effects of allowing multi-homing consumers.

much.

An incremental pricing model in a platform context was first deployed by Armstrong (2002). He uses the setup to show the existence of asymmetric equilibria in media markets when newspapers choose prices, and advertising competition is winner-take-all in a readership game.[3] Ambrus and Reisinger (2006) were the first to recognize that introducing multi-homing consumers could substantially alter the predictions of the single-homing model. Ambrus, Calvano, and Reisinger (2015) (henceforth ACR) supersedes Ambrus and Reisinger (2006), and provides new insight by introducing correlation of consumer tastes (with the result that ads can go up or down with entry).

Athey, Calvano, and Gans (2013) (hereafter ACG) formulate a two-period duopoly platform model.[4] Consumer switching between periods generates overlap of media consumers across platforms. This implies that consumers are exposed to ads from multiple sources, and due to the growth of Internet multi-homing has become much more prevalent. ACG argue convincingly that this helps to explain the collapse of advertising revenue for printed newspapers: the mechanism is effectively that of incremental pricing.[5] Neither ACR nor ACG analyze market media bias in genre selection and how multi-homing consumers affect platforms' choice of genre. ACG keep the total amount of time consumers spend on different platforms fixed, and then nicely isolate the effects of the real-world aspect that consumers use less time on traditional media as they use more time on online media. However, availability

[3] Armstrong (2002) also shows that ad prices go to zero in a symmetric set-up as the number of papers gets large.

[4] Anderson and Coate (2005, Section 7) provide a rudimentary two-period analysis of multi-homing media consumers who are ad-averse.

[5] See the Washington Post article *Econometricians looked at the news business, and it isn't pretty* (Sept 17, 2013) for a popularized version of ACG.

of more content will in most markets increase total consumption, and this feature is built-into both the present model and ACR.[6]

All these three models are looking at the effects of multi-homing consumers in media markets. With different assumptions and model approaches, all three derive that incremental pricing is a crucial force. This certainly indicates incremental pricing as a robust and important result as multi-homing consumers become more prevalent.

The rest of the paper is organized as follows. In Section 2 we derive the principle of incremental pricing as a unique equilibrium. In Section 3 we draw implications from the incremental pricing principle on the effects of allowing a public broadcaster to air ads, of mergers and entry, and on location incentives on the Hotelling line. Section 4 concludes.

2 The model

We describe and discuss in turn the behavior of the three groups of agents: platforms, consumers and advertisers. Then, we define and discuss the equilibrium concept we use.

Platforms

There are n media platforms, $i = 1, .., n$. Each sets a price P_i per advertisement that is included in its TV program, radio show, web-site, magazine, or newspaper. Including ads entails no direct cost to the platform. We assume that it is only the first impression on any given platform which has any value. Since this implies that each advertiser puts at most one ad per platform, the number of advertisers on a

[6] Ofcom (2014) shows how the total media consumption in the UK has increased from approximately 9 hours per day in 2010 to more than 11 hours in 2014.

platform is the same as the number of ads there.

Consumers

Consumers (readers, viewers, surfers, or listeners), choose either zero, one, or more platforms. The "more" option constitutes the crucial added element of the current analysis over the standard "single-homing" set-up. Each platform has a base of exclusive consumers and a base of consumers common with other platforms. Let x^i denote the *exclusive* consumers on platform i, and let s^i_J be the consumers i *shares* with J other platforms. The *total* number of consumers on platform i is thus $x^i + \Sigma_{J=1}^{n-1} s^i_J$.

The consumer allocation depends on the ad levels (which equal the number of advertisers there) expected on the platforms. Consumers may like or dislike ads individually or in aggregate; all we assume is that the consumer allocation is uniquely determined by (expected) ad levels. In keeping with the literature, we let all consumers be intrinsically equally attractive to all advertisers.

We write the number of exclusive consumers on platform i as $x^i(\mathbf{a})$ when consumers expect a vector $\mathbf{a}$ of ad levels on platforms. Likewise, let the number of consumers on platform i shared with J other platforms be $s^i_J(\mathbf{a})$ when consumers expect a vector $\mathbf{a}$ of ad levels on platforms.

Advertisers

The advertisers are homogenous, and each of them is willing to pay b for a successful single contact with a consumer. A consumer reached k times is worth $b\left(1 + \Sigma_{J=1}^{k-1}\sigma_J\right)$, with $\sigma_J \in [0,1]$ and $\sigma_1 \geq \sigma_2 .... \geq \sigma_{n-1}$, so that the $(J+1)^{th}$ impression is worth a (non-increasing) fraction σ_J of the first impression.

For example, suppose there is an independent probability p that the ad on any given platform is registered by a consumer, and that a registered ad gives an expected pay-off to an advertiser of 1. Then $b = p$. An ad aired to the same consumer on another platform raises the chance the ad is registered by $(1-p)\,p$, so that $\sigma_1 = (1-p)$. An ad on a $(J+1)^{th}$ such platform raises the chance by $(1-p)^J\,p$, so $\sigma_J = (1-p)^J$.[7]

Equilibrium

The equilibrium concept is this. First, platforms set prices per ad, each one rationally anticipating the price per ad of the other platforms. Second, advertisers observe these prices, and then choose from which platform(s) to buy ads, anticipating viewer numbers and sharing patterns across platforms. Media consumers do not observe the ad prices, but rationally anticipate ad levels, and choose which platform(s) to join. This assumption seems to be a reasonable description of many market interactions. Consumers rarely observe ad prices, and so they do not react if ad prices change. Instead, consumers just form expectations over ad levels.

Our equilibrium concept is analogous to Katz and Shapiro's (1985) notion of rational, or fulfilled expectations, equilibrium for network goods (see also Hurkens and López, 2014, and Peitz and Reisinger, 2015). Their argument is that this is a reasonable equilibrium concept unless producers of network goods can commit to a given output level towards the (potential) consumers. Note, however, that if consumers are ad averse, then platforms could want to commit to "low" ad levels. Our non-observability assumption implies that they cannot achieve this by setting a high

[7] Another way to see this is to note that the chance of a hit with $J+1$ ads is $1-(1-p)^{J+1}$. So the incremental value of the $(J+1)$th ad is $b\sigma_J = \left(1-(1-p)^{J+1}\right) - \left(1-(1-p)^J\right) = p\,(1-p)^J$.

advertising price. However, in a dynamic setting platforms could for instance build up a reputation for having low advertising intensities (or high intensities if consumers like ads, as might be the case in e.g. fashion magazines).[8]

The assumption that prices are set per ad reflects the idea that rates are set without conditioning on realized viewer numbers.[9] Platforms simply choose a price for putting the ad in the magazine (say): think for example of newspapers charging a fixed price for a full-page ad. This does not mean that ad prices are independent of (predicted) consumer numbers. Indeed, as we shall see, larger consumer numbers will command higher ad prices (modulo the composition of consumer types between exclusives and shared).

2.1 Incremental pricing

Incremental pricing here refers to pricing at the incremental value added to an advertiser's revenue from an ad on a platform, over the revenue the advertiser gets without that ad. The mass of advertisers is A, and we let $\mathbf{A}$ denote the vector of ads when each element equals A (each advertiser places one ad on each platform). When all platforms choose A ads, the number of exclusive consumers on platform i is $x^i(\mathbf{A})$, while the number that i shares with J other platforms is correspondingly given by $s^i_J(\mathbf{A})$. We now show that there exists a unique equilibrium, and ad prices are incremental prices.

[8] Anderson and Coate (2005) and ACR use a different equilbrium concept in that they assume that platforms commit to ad levels at stage 1, before the advertisers and consumers at stage 2 decide whether to join the platform(s). As pointed out by a referee, one could think of this as capturing in a static sense the reputational considerations which might arise in dynamic games.

[9] Although there are examples of contracts where there is some compensation for advertisers should actual consumer numbers fall short of predicted levels. NBC's Olympics contracts involved some provision for viewer numbers falling short of predictions.

Proposition 1 ***(Incremental Pricing)*** *There exists a unique equilibrium, at which each platform sets a price per ad* $P_i = b\left(x^i(\mathbf{A}) + \Sigma_{J=1}^{n-1}\sigma_J s_J^i(\mathbf{A})\right)$*,* $i = 1, ..., n$*. Each advertiser places an ad on each platform. The number of media consumers in each category is* $x^i(\mathbf{A})$ *and* $s_J^i(\mathbf{A})$*,* $i = 1, ..., n$*,* $J = 2, ..., n-1$*. Thus each platform is able to price to advertisers only the value of its exclusive consumers plus the incremental value associated to the shared ones it delivers.*

Proof. We first show that it is a unique equilibrium for each platform to set an ad price $P_i = b\left(x^i(\mathbf{a}) + \Sigma_{J=1}^{n-1}\sigma_J s_J^i(\mathbf{a})\right)$ for any consumer expectations of $\mathbf{a}$. Such incremental pricing constitutes equilibrium platform pricing because if each other platform k prices at $P_k = b\left(x^k(\mathbf{a}) + \Sigma_{J=1}^{n-1}\sigma_J s_J^k(\mathbf{a})\right)$ per ad, then the best reply for any platform i is to price at its incremental value. Any higher price would attract no advertisers, while any lower price could be raised without losing any advertisers. To show uniqueness, first note that any equilibrium has all platforms active. Otherwise, an inactive platform (at any allocation induced by ad prices) can surely do better by charging the value of its exclusive consumers. Given all platforms must be active at any candidate equilibrium, there can be no undercutting and all advertisers must be on each platform. If all advertisers are on each other platform, any platform i must be optimally charging its incremental value. This we already argued is an equilibrium for all to do so, and hence is the unique solution. Finally, all advertisers will then buy ads on each platform i and therefore consumers must rationally expect that $\mathbf{a} = \mathbf{A}$.[10]

■

[10] Note that advertisers are actually indifferent about placing their ads given all their incremental surplus is extracted. Our equilibrium takes the standard approach for when surplus is fully extracted. It cannot be an equilibrium for some not to be present on all platforms: any platform in such a situation would just drop its ad price infinitesimally to ensure full participation.

The equilibrium outcome is surprisingly simple, even though platform best replies involve various different regimes, running the gamut from perfect substitutes through complements. We illustrate with a simple duopoly, and, to fix ideas, let viewer allocations be fixed. Let the number of common (shared) consumers be $s > 0$, and assume that the value of a second impression is zero ($\sigma = 0$). First, note that $P_i = bx^i,\ i = 1, 2$, is a Nash equilibrium. Here each advertiser will advertise at both platforms and pay its reservation price. Thus, it is not profitable for any of the platforms to deviate and charge a higher price, because then it would face zero demand. Neither is it profitable for a platform to charge a lower price, since it already has all advertisers on board. Second, to see that the equilibrium is unique, note that if $P_2 > (b(x^2 + s))$, platform 2 prices itself out of the market regardless of 1's action, and so 1 sets its monopoly price $P_1 = b(x^1 + s)$. However, platform 2's best response to this would be to charge $P_2 = bx^2 + (bs - \varepsilon)$. This would leave platform 1 with zero demand, and so undercutting will take place until both platforms price at incremental value: $P_i = bx^i$. Finally, for completeness, observe that if either of the platforms charges $P_i < bx^i$, the other platform can do no better than charge its incremental value $P_{-i} = bx^{-i}$. Thus, there does not exist any other equilibrium than $P_i = bx^i$.[11]

Clearly, it is not realistic that all advertisers are on all platforms (although one is struck by seeing the same advertisers appearing in similar media, e.g. Time and Newsweek when it was still available). This result is a consequence of our assumptions that consumer attractiveness to advertisers is uncorrelated with consumers' preferred platforms, and that we have a homogenous mass of advertisers (they have

[11] Suppose $x^1 > x^2$. If advertisers had to make an exclusive choice (as per classic discrete choice models), then a Bertrand pricing equilibrium would yield a zero price for platform 2, while 1 charges $P_1 = b\left(x^1 - x^2\right)$, the value of its superiority.

the same values for contacts; the b's and σ's). This way we most starkly demonstrate how competition for advertisers under multi-homing dramatically changes equilibrium outcomes. Interestingly, ACR derive the incremental pricing under a different equilibrium concept.[12]

3 Implications of incremental pricing

We here look at the implications of the incremental pricing principle, and show how allowing for multi-homing consumers may give very different predictions from the (benchmark) single-homing model with respect to:

1. The effects of allowing a public broadcaster to air ads

2. The effects of a merger between platforms

3. The effects of platform entry

4. The effects on platforms' choice of genres

For simplicity, assume that $\sigma_J = 0$ for $J > 1$ so that impressions beyond the first incremental one have no extra value, and call σ_1 simply σ. We have thus implicitly assumed that each ad is observed with certainty. In this case, any consumer shared with more than one other platform will have no market value. Accordingly, let $s^i(\mathbf{a})$ ($=s_1^i(\mathbf{a})$ in the earlier notation) denote the number of consumers platform i shares

[12] The principle of incremental pricing does not hinge on the advertisers being homogenous. However, if they are heterogeneous, some of the advertisers might multi-home and others single-home. As shown in Anderson, Foros, and Kind (2014, work in progress) this might generate an asymmetric equilibrium where one platform attracts a larger audience than its rival, even if the firms are intrinsically identical. ACR also discuss heterogeneous advertisers in an extension, and they show that the key insights with homogeneous advertisers hold also with heterogeneous advertisers.

with just one other platform; where pertinent, let $s^{ik}(\mathbf{a})$ $(=s^{ki}(\mathbf{a}))$ be the number of consumers common to *only* platforms i and k.

3.1 Public broadcaster

One puzzle for the single-homing model is that it predicts that a commercial ad-financed TV channel prefers that a public broadcaster carries ads in its programs as long as consumers dislike ads.[13] This is inconsistent with the fact that ad-financed platforms typically lobby against removing advertising restrictions on public broadcasters. But when consumers multi-home, allowing the public broadcaster to air commercials necessarily introduces competition between the broadcasters in the ad market.

Consider the case of $n-1$ private ad-financed platforms and one public one, label it p. At the outset the public broadcaster is not allowed to air ads. Let $\mathbf{A_0}$ denote the vector of ad levels with the public firm having an ad level of 0, and all others carrying A ads each (and let $\mathbf{A}$ denote the vector with all n platforms' ads equal to A). Private broadcaster i can charge b for its $(x^i(\mathbf{A_0}) + s^{ip}(\mathbf{A_0}))$ consumers not attending any other private platform, because the overlapped ones cannot be reached by ads through the public platform, plus $b\sigma$ for the $\Sigma_{k\neq\{i,p\}}s^{ik}(\mathbf{A_0})$ consumers shared with the other private ones.

Now let the public platform air ads, and let it behave competitively in the advertising market. Then, as per Proposition 1, in the subsequent ad pricing equilibrium, all platforms will air A ads. The puzzle under single-homing arises in presence of ad nuisance. Hence, we now assume that ads are a nuisance and that the total numbers

[13] If ads are desirable to consumers, the opposite prediction holds, but it is difficult to imagine TV ads are valued more than programming.

of consumers on each platform strictly increases in the level of ads on the public platform:[14]

$$x^i(\mathbf{A}) + \Sigma_{k \neq i} s^{ik}(\mathbf{A}) > x^i(\mathbf{A_0}) + \Sigma_{k \neq i} s^{ik}(\mathbf{A_0}) \text{ for all } i \neq p.$$

Denote Old (O) as the case where the public channel is banned from airing ads, and New (N) as the outcome where it is allowed to do so. The corresponding consumer numbers are the RHS and LHS in the preceding inequality.

The equilibrium price for platform i with the ban is

$$P_O^i = b\left(x^i(\mathbf{A_0}) + s^{ip}(\mathbf{A_0}) + \sigma\Sigma_{k \neq i,p} s^{ik}(\mathbf{A_0})\right),$$

while the equilibrium price for platform i when platform p carries ads is

$$P_N^i = b\left(x^i(\mathbf{A}) + \sigma\Sigma_{k \neq i} s^{ik}(\mathbf{A})\right).$$

Profits are proportional to ad prices in both cases because each private platform carries A ads in equilibrium. Then

Proposition 2 *Assume that private platforms' consumer numbers are a strictly increasing function of the ad level on p. If a public platform is (newly) allowed to air ads, then private platforms' equilibrium profits*

- *rise if consumers single-home.*

[14] This holds, for example, in a discrete choice model enhanced to include choices of several options, such as in Gentzkow (2007).

- *fall if consumers multi-home, σ is sufficiently small and the new exclusive base is smaller than the old base of exclusives plus those shared with the public platform; i.e., $x^i(\mathbf{A}) < x^i(\mathbf{A_0}) + s^{ip}(\mathbf{A_0})$.*

Proof. $P_O^i > P_N^i$ iff $x^i(\mathbf{A_0}) + s^{ip}(\mathbf{A_0}) + \sigma\Sigma_{k\neq i,p}s^{ik}(\mathbf{A_0}) > x^i(\mathbf{A}) + \sigma\Sigma_{k\neq i}s^{ik}(\mathbf{A})$. Under single-homing all the s terms in these equilibrium prices are zero. Then $P_N^i > P_O^i$, because $x^i(\mathbf{A}) > x^i(\mathbf{A_0})$ by assumption. With multi-homing consumers, $P_O^i > P_N^i$ is true for σ (≥ 0) small enough if $x^i(\mathbf{A_0}) + s^{ip}(\mathbf{A_0}) > x^i(\mathbf{A})$, thus proving the sufficient condition for private platforms' profits to fall when the public broadcaster is allowed to air ads. ■

Hence, whether commercial platforms' profits rise or fall depends on the number of consumers gained and the value of overlap.[15] Under pure single-homing, profits fall as long as demand rises for the private platforms (all the s terms in the equilibrium prices are then zero), and we have the "puzzle" that the private platforms like it when the public platform, p, carries ads.

We also noted that if consumers are ad-neutral, so that consumer allocations are independent of ad levels, private platforms are indifferent as to whether a public broadcaster carries ads when consumers single-home. This is clearly not the case with multi-homing consumers. In equilibrium, with multi-homing consumers, incremental pricing implies an ad price for each platform of $b\left(x^i + \sigma\Sigma_{k\neq i}s^{ik}\right)$. The private platform now charges less overall (if $\sigma < 1$) because it has lost the exclusive ability to deliver the s^{ip} consumers to advertisers, and is therefore worse off. The argument

[15] A necessary condition for $P_O^i > P_N^i$ is that $x^i(\mathbf{A_0}) + s^{ip}(\mathbf{A_0}) + \sigma\Sigma_{k\neq i,p}s^{ik}(\mathbf{A_0}) > x^i(\mathbf{A}) + \sigma\Sigma_{k\neq i}s^{ik}(\mathbf{A}) > x^i(\mathbf{A_0}) + \Sigma_{k\neq i}s^{ik}(\mathbf{A_0}) + (\sigma - 1)\Sigma_{k\neq i}s^{ik}(\mathbf{A})$, where the latter strict inequality comes from the stipulation that platform i's demand strictly increases in p's ad level. Rearranging the first and last terms, a necessary condition for private platforms' equilibrium profits to fall is that $(1-\sigma)\left(\Sigma_{k\neq i}s^{ik}(\mathbf{A}) - \Sigma_{k\neq i,p}s^{ik}(\mathbf{A_0})\right) > 0$.

readily extends to valuable impressions beyond the second: consumers are "down-shifted" into less valuable categories once they are shared with another active player (the public platform).[16]

The result that commercial platforms might dislike public broadcasters to carry ads under multi-homing is the opposite of the conventional wisdom from the single-homing consumer model. However, our result is consistent with the opposition that private broadcasters show against proposals to allow (more) ads in public channels (as already noted by Ambrus and Reisinger, 2006). ACG arrive at a similar result as ours by assuming that viewers must allocate a fixed amount of viewing time across the available TV channels. If the public TV channel has no commercials, the advertisers' ability to reach the viewers is thus more limited. This increases the advertising price. Interestingly, Reisinger (2012) finds a similar result in a setting where he supposes that both advertisers and consumers single-home.

The European Commission imposes a general cap on ad volumes for all ad-financed television platforms ("Audiovisual Media Service Directive", March 2010). However, several countries impose an asymmetric regulation, such that public broadcasters face stricter restrictions than commercial ad-financed platforms. In the UK, BBC is not allowed to air ads at all (the same is true for public broadcasters in Scandinavia), and in Germany the two biggest public broadcasters must be ad-free during evening prime time. Similar restrictions apply in France, Netherlands and Spain (see Stümeier and Wenzel, 2012). As accentuated above, the common anticipation is that such asymmet-

[16] In this case, when the public broadcaster airs no ads, private platform i's profit is $\pi_i = b\left(\tilde{x}^i + \Sigma_{J=1}^{n-2}\sigma_J \tilde{s}_J^i\right) A,\ i = 1, ..., n-1$, where $\tilde{s}_J^i$ denotes the number of consumers i shares with J other private firms, and $\tilde{x}^i$ denotes the number of i's exclusives, counting in that group any shared just with the public platform. When platform n airs ads, private platform i's profit falls to $\pi_i = b\left(x^i + \Sigma_{J=1}^{n-1}\sigma_J s_J^i\right) A$, where $\tilde{x}^i \geq x^i$, etc., so incremental values are reduced.

ric regulation benefits commercial ad-financed platforms. Consistent with this, the private broadcasters' association in Germany complaints towards proposals to allow public broadcasters to air ads during evening prime time. Interestingly, the German advertising industry association finds evidence that ad prices are higher during times when the public broadcaster is not allowed to air ads (Stümeier and Wenzel, 2012. In France, the networks TF1, M6, TNT, RTL, NRJ, Lagardere, NextRadio TV and L'Equipe joined forces and warned the government that letting public broadcasters to re-enter the ad market on the web will harm private broadcasters.[17] The same kind of concerns are evident also in Scandinavia.

3.2 Merger

In presence of ad nuisance, the prediction from single-homing models is that a merger between ad-financed platforms reduces ad prices per consumer. The standard single homing models then fail to explain why competition authorities might have concerns about the effects of platform mergers on advertisers. We now show how allowing for multi-homing may reverse the pricing result. Consider a merger between two private platforms, 1 and 2, from n platforms. We then have the following result:

Proposition 3 *A merger between platforms strictly increases advertising prices per consumer when the merging platforms have some overlapping consumers.*

Proof. The ad prices prior to merger are $P_i = b\left(x^i\left(\mathbf{A}\right) + \sigma s^i\left(\mathbf{A}\right)\right)$, $i = 1, 2$, where $s^i\left(\mathbf{A}\right)$ is the number of shared consumers for platform i. The merged entity can charge a price for access to the consumers of both platforms of $b(x^1\left(\mathbf{A}\right) + x^2\left(\mathbf{A}\right) +$

[17] See http://www.hollywoodreporter.com/news/european-public-broadcasters-crisis-tax-584058.

$\sigma s^1(\mathbf{A}) + \sigma s^2(\mathbf{A}) + (1-\sigma)\, s^{12}(\mathbf{A}))$ where $s^{12}(\mathbf{A})$ is the number shared between the two merging platforms. After merger, A ads are aired on each merged platform, and so the consumer allocation is unaffected by the merger. To see that this is the unique equilibrium, note that the merged entity charges its incremental value, and that the other platforms continue to charge their incremental values.

The increase over the pre-merger prices is $(1-\sigma)\, s^{12}(\mathbf{A})$: each consumer jointly shared used to command σ on each platform, and commands $(1+\sigma)$ post-merger, meaning an increment of $(1-\sigma)$ for each such consumer. The post-merger outcome yields a higher price per ad per consumer and strictly more profits for $(1-\sigma)\, s^{12}(\mathbf{A})$ > 0 (so, for $s^{12}(\mathbf{A}) > 0$ and $\sigma < 1$). $\blacksquare$

After the merger, the overlap in consumers within the merged entity is converted from being priced at individual incremental value to joint incremental value. That is, the combined entity can fully charge for the overlapped consumers between the two platforms that are exclusive to that pair.

Higher prices here contrast with lower prices predicted by the standard benchmark model. An alternative way of seeing the benefits of a merger (to the participants) is as follows. Take the simple case when only exclusive consumers are valued ($\sigma = 0$). The number of exclusives is "super-additive" in the sense that the number of exclusive consumers reached under merger is greater than the sum of exclusive consumers *prior* to the merger. This super-additivity gives rise to a motive to merge even in the absence of consumer price effects.

The logic of the discussion above generalizes to the case of multiple impression values. The price per ad after merger on the merged entity is the sum of the prices before merger plus the increased value from increased exclusivity.

Our result in Proposition 3 is consistent with Jeziorski (2014). Through a structural model that employs data from the US radio market, he finds that the merger wave between 1996 and 2006 resulted in an 11 percent reduction in ad volume and a 6 percent increase in ad prices.[18]

3.3 Platform entry

Let us now consider increasing the number of platforms. Our main interest for much of media economics is when consumers are ad-averse. Then, because the (unique) post-entry equilibrium still involves ad levels A per platform, we would expect each platform's exclusive consumers to decline in number as they are divided among more platforms. Moreover, even if the number of shared consumers were to go up on a platform, we would not expect it to offset the loss in exclusives, so total consumer numbers per platform should be expected to decline. We show that the ad price $P^i = b(x^i(\mathbf{A}) + \sigma s^i(\mathbf{A}))$ goes down with entry if indeed $x^i(\mathbf{A})$ and $x^i(\mathbf{A}) + s^i(\mathbf{A})$ go down. We further show that if the burden of entry falls proportionately more on incumbents' exclusives, then the price per ad per consumer falls.

Proposition 4 *Suppose that $x^i(\mathbf{A})$ and $T^i \equiv x^i(\mathbf{A}) + s^i(\mathbf{A})$ both decrease with entry. Then entry decreases the price per ad. Moreover, the price per ad per consumer decreases if the number of shared consumers goes up with entry or if it falls proportionately less than does the number of exclusives.*

[18] In a comprehensive survey on mergers in two-sided markets, Filistrucchi et al. (2010) emphasize that the two-sided nature is not completely taken into account by competition authorities when they analyze merger cases. However, UK Office of Fair Trading often make a distinction between markets where consumers single-home and markets where they multi-home. In markets with multihoming, UK Office of Fair Trading seems to fear that mergers will increase ad prices and thus harm advertisers.

Proof. Let a subscript O denote the old viewer number, and an N denote a new (post-entry) one. Then $P^i_O > P^i_N$ if $(x^i(\mathbf{A_0})+\sigma s^i(\mathbf{A_0})) > (x^i(\mathbf{A_N})+\sigma s^i(\mathbf{A_N}))$. This clearly holds if both $x^i(\mathbf{A})$ and $s^i(\mathbf{A})$ go down.

So suppose $s^i(\mathbf{A})$ goes up. To show that the price per ad still falls, we rewrite $P^i(\mathbf{A}) = b(x^i(\mathbf{A}) + \sigma s^i(\mathbf{A})) = b(T^i(\mathbf{A}) - (1-\sigma)s^i(\mathbf{A}))$. We then have$P^i(\mathbf{A}_N) - P^i(\mathbf{A}_0) = -b\{[T^i(\mathbf{A}_0) - T^i(\mathbf{A}_N)] + (1-\sigma)[s^i(\mathbf{A_N}) - s^i(\mathbf{A_0})]\}$. Since the terms in both the square brackets are positive, and $\sigma < 1$, it follows that $P^i(\mathbf{A}_N) < P^i(\mathbf{A}_0)$.

Let us next consider the price per ad per consumer:

$$\frac{P^i(\mathbf{A})}{T^i(\mathbf{A})} = b\frac{x^i((\mathbf{A})) + \sigma s^i((\mathbf{A}))}{x^i((\mathbf{A})) + s^i((\mathbf{A}))} = b\left[1 - \frac{(1-\sigma)}{x^i(\mathbf{A}) + s^i(\mathbf{A})}s^i(\mathbf{A})\right].$$

We now have

$$\frac{P^i(\mathbf{A}_N)}{T^i(\mathbf{A}_N)} - \frac{P^i(\mathbf{A}_0)}{T^i(\mathbf{A}_0)} = \frac{b(1-\sigma)}{T^i(\mathbf{A}_0)T^i(\mathbf{A}_N)}\left[x^i(\mathbf{A}_N)s^i(\mathbf{A}_0) - x^i(\mathbf{A}_0)s^i(\mathbf{A}_N)\right].$$

It follows that $\frac{P^i(\mathbf{A}_N)}{T^i(\mathbf{A}_N)} < \frac{P^i(\mathbf{A_0})}{T^i(\mathbf{A_0})}$ if $\frac{x^i(\mathbf{A_N})}{x^i(\mathbf{A_0})} < \frac{s^i(\mathbf{A_N})}{s^i(\mathbf{A_0})}$.Given that the number of exclusives goes down, it therefore suffices that the number of shared viewers rises or that it falls less than the number of exclusives. More keenly, rewriting the last condition as $\frac{\Delta_x}{x^i(\mathbf{A_0})} < \frac{\Delta_s}{s^i(\mathbf{A_0})}$, where $\Delta_s = s^i(\mathbf{A_N}) - s^i(\mathbf{A_0})$ and $\Delta_x = x^i(\mathbf{A_N}) - x^i(\mathbf{A_0})$, we have the result claimed. ■

ACR analyze the obverse facet, namely how entry affects an incumbent's advertising level. One interesting result in ACR is that the advertising level might increase. This hinges on the fact that a monopoly platform which increases its advertising volume by definition loses only exclusive viewers, while a platform which faces competition loses both exclusive and non-exclusive viewers. The latter have a relatively low value in the advertising market. Other things equal, this means that it is relatively more expensive for a monopoly to lose viewers than for a duopolist. ACR use this insight to explain why CNN increased its advertising volume subsequent to the entry of Fox News; it had little to gain from upholding its "low" monopoly advertising volume to maintain a large audience, because a large share of these would be low-value multi-homers.[19]

3.4 Platforms' choice of genre

Finally, let us analyze the implications that IP has for firms' differentation incentives on the Hotelling line. Recall that with assumptions of uniform consumer distribution, ad-neutral and single-homing consumers, two ad-financed rivals will locate in the middle of the line (genre duplication).[20] The traditional way of overturning Hotelling's minimum differentiation outcome (in a world of single-homing consumers) is to introduce "indirect price" competition through ad nuisance for consumers. The equilibrium ad level is zero if the platforms choose exactly the same genre, but they

[19] ACR argue that viewer preferences for the programs broadcast by CNN and FOX are negatively correlated, while viewer preferences across e.g. sports channels are positively correlated. A sports channel which increases its advertising level might therefore lose exclusive viewers, just as in a standard single-homing context, implying that entry reduces the ad volume. Their empirical evidence is consistent with this prediction.

[20] One of the early contributions to media economics (Steiner, 1952) emphasized how equilibrium genre choice could differ across market structures. Steiner (1952) used a fixed set of genres, and showed how market equilibrium could lead to duplication of popular formats, whereas monopoly might provide greater diversity. Beebe (1977) extended Steiner's (1952) model to allow consumers to have second (or third, etc.) preferences. The idea is that consumers will consume a second preference if the first is not available, but otherwise the framework is like Steiner's. Beebe's main point is that a monopoly platform might provide content that no consumer likes most, but will attend if nothing else is available – Lowest Common Denominator (LCD) programming. In an earlier version of this paper we show that the presence of multi-homing consumers may mitigate LCD duplication. Exclusive consumers' tastes will be strongly represented in platforms' offerings, while multi-homing consumers' preferences will be under-weighted. It is straightforward to transfer the classical duplication result from Steiner (1952) into a Hotelling framework (see discussion by Anderson and Gabszewicz, 2006).

can avoid this "Bertrand paradox" outcome by differentiating their profiles (Tirole, 1988, terms such incentives the "Principle of Differentiation"). To highlight that the mechanism in the present paper is different, and hinges on the incentives to attract exclusive consumers, we assume away ad nuisance when analyzing choice of genres.

From Proposition 1 (Incremental Pricing) we have that each platform is able to price to advertisers only the value of its exclusive consumers plus the incremental value associated to the shared ones. Hence, exclusive consumers are more valuable, and this give raise to the conjecture that platforms choose genres that attract exclusive consumers. To see how multi-homing consumers might affect the choice of genres, we use a Hotelling model. In order to extend the model in this direction, we analyze only two platforms (as is common in spatial models), and we close down ad nuisance as mentioned.

Remarkably, we find that with multi-homing consumers, the genre choices are independent of whether the platforms compete or merge. A main result is that because platforms are interested in chasing exclusive consumers, the majority may be poorly served when they overlap platforms.

3.4.1 Single-homing consumers

Consumer ideal points are distributed on $[0,1]$ according to a quasi-concave density function $f(\cdot)$, which is symmetric about $1/2$, with cumulative distribution $F(\cdot)$. Consider first the standard assumption of single-homing consumers (no multi-homing). Let the surplus of a consumer with ideal point at z be $R - t\left|z - z_i\right|$ when consuming media product (genre) $i = 1, 2$ located at z_i. Assume that the market is not fully covered ($R < t/4$ suffices), and let $z_2 \geq 1/2$. When the inter-platform interval is covered, platform 1 serves consumers up to $\frac{z_1+z_2}{2}$, and the left-most point it serves is $z_1 - \frac{R}{t}$. Thus, its profit is $\pi_1 = b\left[F\left(\frac{z_1+z_2}{2}\right) - F\left(z_1 - \frac{R}{t}\right)\right]$. Platform 1's location derivative (for $z_1 < z_2$) is consequently $\frac{b}{2}f\left(\frac{z_1+z_2}{2}\right) - bf\left(z_1 - \frac{R}{t}\right)$. Equilibrium locations thus entail Minimum Differentiation if $f(1/2) > 2f\left(\frac{1}{2} - \frac{R}{t}\right)$, i.e., when the density is steep enough. Otherwise, setting $z_2 = 1 - z_1$ yields a symmetric interior solution at which

$$\frac{1}{2}f\left(\frac{1}{2}\right) - f\left(z_1 - \frac{R}{t}\right) = 0, \tag{1}$$

which implicitly determines platform 1's location at a symmetric equilibrium. Each platform trades off picking up half a unit of market length worth the value of the number of consumers at the market mid-point with losing a unit of length worth the number of consumers on its outside. The lower the "transport" costs and the greater the consumers' reservation price (R), the closer will the platforms locate.

At the duopoly equilibrium, (1), consumers at the mid-point obtain a strictly positive surplus. This cannot be optimal for a monopoly operating two platforms. It will instead locate to cover the maximal market each side of the mid-point (i.e., at $z_1 = \frac{1}{2} - R/t$, yielding zero consumer surplus at $z = 1/2$). These locations are thus *further apart than under competition*, as the monopolist internalizes business-stealing on its sibling genre.

3.4.2 Multi-homing consumers

We now introduce the multi-homing option for consumers. The more preferred genre for a consumer is the closer one. Suppose that the incremental consumer surplus from adding the less preferred genre is $(R - t\,|z - z_i|)\,\alpha$ where $\alpha \in [0,1]$. This formulation is motivated in Anderson, Foros, and Kind (2013)[21]: loosely, α is the discount to surplus of consuming a second (less preferred) platform.[22]

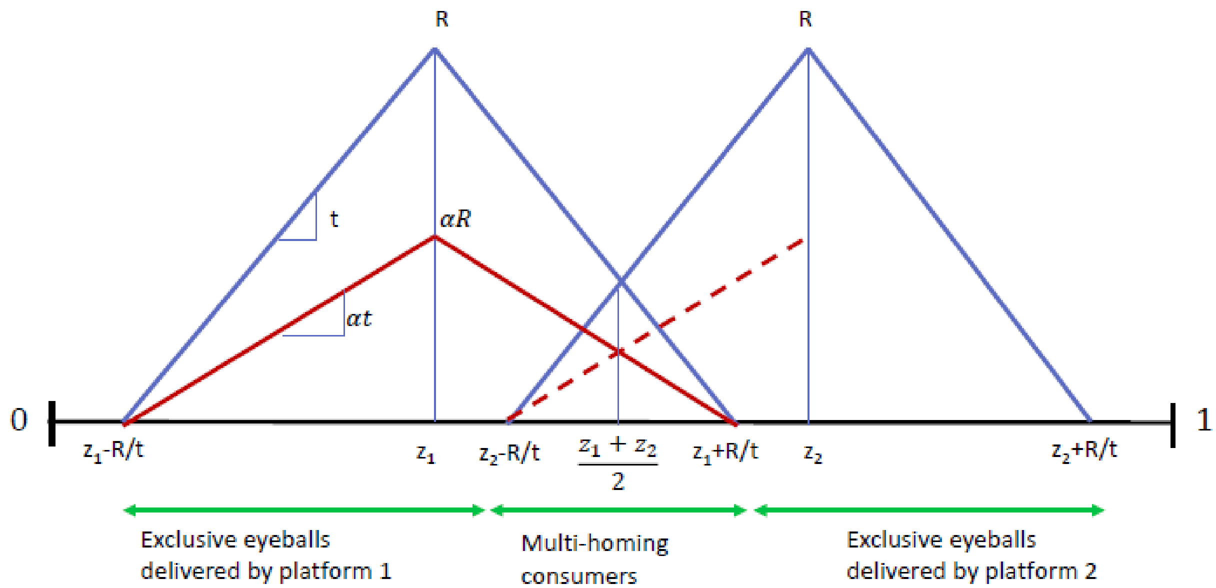

Figure 1: Multi-homing consumers

Figure 1 shows the valuations for first choices as the upper triangles. The lower triangles show the incremental surplus from a second option. The overlap region is where both the first and second surpluses are positive (the first choice is always the closer media platform).

[21] Anderson, Foros and Kind (2013) allow for multi-homing consumers in a traditional Hotelling market structure. There is no advertising - the model has no two-sided market structure.

[22] The discount reflects overlapping story content in the magazine/newspaper example. Thus a consumer never consumes two units of the same magazine (because then $\alpha = 0$). Ambrus and Reisinger (2006) use a somewhat similar construct. Peitz and Valletti (2008) provide an appealing alternative framework for modeling multi-homing.

Suppose first that $\sigma = 0$. Then overlapped consumers are worthless, and so platforms avoid picking up *any* of them by locating far enough away from the rival that there are *no* overlapped consumers. That is, equilibrium locations satisfy $z_1 + 2\frac{R}{t} = z_2$. Under symmetry, then $z_1 = \frac{1}{2} - \frac{R}{t}$, which is the same as for a two-platform monopoly.[23] The reason is as follows. A two-platform monopoly wants the largest market base, so it ensures that the middle consumer is indifferent between consuming and not. Hence, it sets up R/t from the center. Competition is the same because moving in just picks up worthless multi-homers, while losing valuable single-homing consumers on the outside. *The equivalence of market structures is a striking difference from Steiner (1952).* Another key difference is that the most popular tastes (at the market center) garner no surplus. Far from over-serving the most popular preferences (the Steiner result), here they are neglected. Instead, the intermediate taste types do best, while the minorities in the far wings are still unserved. Finally, the social optimum locations are closer in than the equilibrium ones because social welfare adds consumer surplus to (joint monopoly) profits, and consumer surplus is locally increasing as locations move toward the center. In summary:

Proposition 5 *Consider a Hotelling model with quasi-concave symmetric consumer density and endogenous multi-homing. If a second impression has no value ($\sigma = 0$), then competing platforms as well as a two-platform monopoly locate at $(z_1, z_2) = \left(\frac{1}{2} - \frac{R}{t}, \frac{1}{2} + \frac{R}{t}\right)$. No consumer multi-homes in equilibrium, and the consumer at the market center gets no surplus.*

[23] There are also asymmetric location equilibria satisfying $z_1 + 2\frac{\tilde{R}}{t} = z_2$ for $\sigma = 0$. However, symmetric locations constitute the unique equilibrium for $\sigma > 0$.

As we show next, for $\sigma \in (0,1)$, the equilibrium locations are unique, and converge as σ rises. This is the interesting case, as platforms get close enough that there are multi-homing consumers. Platform 1's left-most consumer, when interior, is as above. But its furthest (right-most) consumer is given by applying its analogous "monopoly" condition using the marginal consumer's incremental value from adding 1. Similarly, its first (left-most) overlapped consumer is given by applying its *rival's* monopoly condition using incremental values! Pulling this together, platform 1's problem is to maximize $\pi_1 = b\left(\sigma\left(F\left(z_1 + \frac{R}{t}\right) - F\left(z_2 - \frac{R}{t}\right)\right) + F\left(z_2 - \frac{R}{t}\right) - F\left(z_1 - \frac{R}{t}\right)\right)$. See Figure 1. Setting the locational profit derivative to zero gives

$$b\sigma f\left(z_1 + \frac{R}{t}\right) - bf\left(z_1 - \frac{R}{t}\right) = 0.$$

Compared to the single-homing case, the second term is the same (because it is on the margin between monopoly and not participating).[24] The first term is quite different: the problem has reduced to an (asymmetric) monopoly problem because the multi-homing decision is incremental and has obliterated the margin between single-homers.

The larger the value σ of a multi-homing consumer, the larger the weight given to the inside margin. The solution is independent of the other firm's location: it increases in σ and only attains the center (minimum differentiation) for $\sigma = 1$. Intuitively, given multi-homing of consumers, the marginal profit of moving towards the rival is independent of its location; only the gain from attracting extra multi-homers compared to the cost of losing some exclusives matters. Though the co-location at $\sigma = 1$ may look like traditional minimum differentiation, it is for quite non-standard

[24] The second derivative is negative (for all $z_1 < 1/2$) as long as $f(\cdot)$ is concave, which condition therefore suffices for a concave profit function – this condition is used below.

reasons. The two platforms are in the middle of the market because this is each one's monopoly position!

We next substantiate the claim that a two-platform monopoly has the same outcome as under competition. This might seem surprising, since the value of a multi-homer for a monopoly is $(1+\sigma)b$ while it is only σb for a competing firm. However, the benefit for a monopoly of turning an exclusive into a multi-homer is σb, which is equivalent to the value of a multi-homer for duopolist. The first-order conditions are thus the same in the two cases, so we have the same result. Summing up:

Proposition 6 *Consider a Hotelling model with quasi-concave symmetric consumer density and endogenous multi-homing. Equilibrium platform positions are independent of market structure (monopoly or competition). Platform positions are independent of α, and get closer the higher is σ. The platforms minimally differentiate iff $\sigma = 1$.*

As regards the social optimum, it remains *inside* the equilibrium as long as the benefit from a second platform is large enough. This contrasts with the usual single-homing result of insufficient differentiation. To find the social optimum relative to the equilibrium, we need to find the consumer surplus derivative from moving closer to the middle. This is the change in total transport cost,[25] which, under symmetry (so the median consumer is half-way between the platforms) is

$$-\left(F\left(z_1\right)-F\left(z_1-\frac{R}{t}\right)\right)+\left(\frac{1}{2}-F\left(z_1\right)\right)+\alpha\left(F\left(z_1+\frac{R}{t}\right)-\frac{1}{2}\right).$$

[25] Changes in the active consumer support can be ignored because marginal consumers get zero surplus; likewise, switchers between single- and multi-homing get the same surplus from each option at the margin.

The first term here is the loss in getting further from the consumers on the outside; the middle term is the gain getting closer to those on the inside who have 1 as their more preferred platform; the last term is the gain for getting closer to those with 1 as the less-preferred platform (so they are attributed a transport cost discounted by α). The consumer problem, taking symmetric locations, is readily shown to be concave for the relevant range $z_1 \in \left[\frac{1}{2} - \frac{R}{t}, \frac{1}{2}\right]$ when $f(\cdot)$ is concave.[26] Under symmetry, then the solution for the consumer surplus maximum is where

$$\left(\frac{1}{2} - 2F(z_1) + F\left(z_1 - \frac{R}{t}\right)\right) + \alpha\left(F\left(z_1 + \frac{R}{t}\right) - \frac{1}{2}\right) = 0.$$

Applying the implicit function theorem,

$$\frac{dz_1}{d\alpha} = \frac{-\left(F\left(z_1 + \frac{R}{t}\right) - \frac{1}{2}\right)}{-2f(z_1) + f\left(z_1 - \frac{R}{t}\right) + \alpha f\left(z_1 + \frac{R}{t}\right)};$$

both the top and bottom are negative, so the whole is positive, which means that higher α gives more central solutions. Note that for $\alpha \to 1$ the solution is at the middle ($z_1 = \frac{1}{2}$).[27]

[26] The second derivative is $-2f(z_1) + f\left(z_1 - \frac{R}{t}\right) + \alpha f\left(z_1 + \frac{R}{t}\right)$. This is less than $-2f(z_1) + f\left(z_1 - \frac{R}{t}\right) + \alpha f\left(z_1 + \frac{R}{t}\right)$, which is negative by concavity of $f(\cdot)$.

[27] If $u = R - t|z - z_i| > 0$, a consumer has a positive utility of his most preferred as well as his less preferred genre (since the utility of the latter is α times the utility of the former). An interesting twist, as suggested by one of the referees, is to set the utility of consuming the less preferred genre equal to $u^L \equiv \max(R - t|z - z_i| - \alpha, 0)$. For any $\alpha > 0$, the location of the marginal consumer wrt to the most preferred and less preferred genre would then differ. This might seem more reasonable than our "co-location" formulation in many cases. However, the qualitative results on the platforms' choice of location would still hold. To see this, consider Figure 1. With utility function u^L, the lower "tent" for multi-homing valuation would be below and vertically parallel to the current pivoted version. But we would still get an interval of multi-homing consumers, and if a second impression is worthless (as per Proposition 5), we would still get that both competition and a two-platform monopoly would locate so as to leave no consumer multi-homing. Likewise, the logic of Proposition 6 still holds. Thus, it is still true that a merger need not increase diversity, and that the tendency to minimally differentiate is mitigated by the presence of multi-homing consumers with lower value

Hence, if the consumer density function is concave, then both the consumer surplus and firm profit functions are concave, and so total welfare is a concave function. Then, if the consumer surplus derivative is negative at the equilibrium, then the full social optimum (consumer surplus plus firm profits) is outside the equilibrium, using the second part of the previous Proposition. Because the consumer surplus and profit problems have parameters (σ and α) that are specific to them, we can state:

Proposition 7 *Consider a Hotelling model with a symmetric concave consumer density function and endogenous multi-homing. For any $\sigma < 1$, there exists a value of $\alpha < 1$ such that optimal locations are in closer than the equilibrium ones.*

Conversely, if σ is large enough, then there exists α low enough that equilibrium platform locations are too far apart. Thus, platforms locate too far apart when the value of overlap is low (see also Proposition 5) and when the consumer benefit from multi-homing is high.

4 Concluding remarks

Standard models of advertising-financed media platforms assume single-homing consumers, giving rise to a "competitive bottleneck" (Armstrong, 2002, 2006, and Armstrong and Wright, 2007) with no effective competition for advertisers. Direct competition for advertisers ensues if consumers multi-home, where multi-homing consumers are less valuable for platforms. Such competition for advertisers fundamentally changes results in the recent literature on two-sided media platforms (e.g., Anderson and Coate, 2005).

than single-homers.

With multi-homing consumers, the emphasis turns to exclusive consumers rather than just consumer numbers as platforms chase exclusive consumers. Then platforms can want to differentiate from rivals in order to deliver exclusive eyeballs to advertisers. More generally, we show that platforms locate too far apart if consumers value overlapping content a lot, and/or second impressions have low value. Because exclusive consumers are more valuable for the platforms, their tastes will be strongly represented in platforms' offerings, while overlapped consumers' preferences will be under-weighted.

Introducing competition for advertisers also provides lessons for competition policy, and it is necessary to look at both sides of the market in, for instance, merger analyses. As accentuated above, ad-financed media platforms will compete by delivering media genre diversity in order to attract exclusive eyeballs. This moderates the conventional pro-merger effect in media markets; i.e. that common ownership increases genre diversity.

Empirical evidence on how mergers affect diversity is mixed, and the hypothesis that mergers increase diversity cannot be rejected; see e.g. Berry and Waldfogel (2001), Jeziorski (2014) and Sweeting (2010) for radio, George and Oberholzer-Gee (2011) and Baker and George (2010) for television, and George (2007) for newspapers.[28] However, prevailing wisdom among policy makers runs the other direction. They often invoke the goal of diversity to justify restrictions on ownership concentration in media markets, although indeed one must carefully distinguish diversity of viewpoints from diversity of genres. The main economic rationale behind restric-

[28] George and Oberholzer-Gee (2011, p. 3) summarize the empirical literature: "... results suggest that business stealing and ownership effects are important in media markets. Regulations designed to foster competition by limiting ownership concentration might thus serve to reduce diversity".

tion on ownership in media is supply-side media bias (e.g., Gentzkow and Shapiro, 2008, Besley and Prat, 2006). For demand-side media bias, Mullainathan and Shleifer (2005) show how tougher competition may lead to more media bias (media platforms may become more radical than the population).

A recent empirical paper on ideological diversity in the US newspaper market is Gentzkow, Shapiro, and Sinkinson (2014).[29] About 15% of the readers in their data set multi-home. Consistent with the theoretical assumption in the present paper and in ACR, they find that exclusive readers are significantly more valuable than overlappers, and that advertising competition depends crucially on the extent of multihoming. Gentzkow et al. do not specifically consider choice of genre or mergers, but their empirical analysis reveals that joint ownership reduces entry. However, fixing the number of market participants, they do not find any clear relationship between ownership structure and differentiation. This fits well with our theoretical results.

We have assumed that advertiser willingness to pay is independent of which other advertiser contacts a media consumer (and ergo prospective product consumer). If instead advertiser demands were interdependent, another virtue to platforms from delivering exclusive consumers might come into play. Specifically, the older literature on competing advertisers within industries (e.g. Butters, 1977, Grossman and Shapiro, 1984) specifies that ads are sent randomly. But, if ads are channeled through media, advertisers have an incentive to place ads on platforms with little consumer overlap in order to relax price competition by diminishing the overlap footprint of consumers knowing about rival products. They are less able to do this when (some) consumers multi-home; this conduit delivers a further premium to media platforms

[29] The conceptual underpinnings to their empirical analysis are founded in models of overlap like this paper.

for delivering exclusive consumer bases.

5 References

Ambrus, A., E. Calvano, and M. Reisinger (2015): Either or both competition: A "two-sided" theory of advertising with overlapping viewerships. Working Paper.

Ambrus, A. and M. Reisinger (2006): Exclusive vs. Overlapping Viewers in Media Markets, Working Paper. (This is an early draft of the previous paper).

Anderson, S. P. and S. Coate (2005): Market provision of broadcasting: A welfare analysis. *Review of Economic Studies*, 72, 947-972.

Anderson, S. P., Ø. Foros, and H. Kind (2013): Product quality, competition, and multi-purchasing. Work in progress.

Anderson, S. P., Ø. Foros, and H. Kind (2014): Two-sided multi-homing in media markets: Heterogenous advertisers and overlapping viewers. Work in progress.

Anderson, S. P., Ø. Foros, H. J. Kind, and M. Peitz (2012): Media market concentration, advertising levels, and ad prices. *International Journal of Industrial Organization*, 30(3), 321-325.

Anderson, S. P. and J. J. Gabszewicz (2006): The Media and Advertising: A Tale of Two-sided Markets. In Ginsburgh, V. and D. Throsby (eds.) Handbook of the Economics of Art and Culture, Elsevier Science.

Armstrong, M. (2002): Competition in two-sided-markets. Mimeo, Nuffield College, Oxford.

Armstrong, M. (2006): Competition in two-sided-markets. *RAND Journal of Economics*, 37(3), 668-691.

Athey, S., E. Calvano, and J. Gans (2013): The impact of the internet on advertising markets for news media. NBER Working Paper 19419.

Baker, M. J. and L. M. George (2010): The role of television in household debt: Evidence from the 1950's. *B. E. Journal of Economic Analysis & Policy*, 10(1) (Advances), Article 41.

Beebe, J. H. (1977): Institutional structure and program choices in television markets. *Quarterly Journal of Economics,* 91(1), 15–37.

Berry, S. and J. Waldfogel (2001): Do mergers increase product variety? Evidence from radio broadcasting. *Quarterly Journal of Economics*, 116(3), 1009-1025.

Besley, P. and A. Prat (2006): Handcuffs for the grabbing hand? Media capture and government accountability. *American Economic Review*, 96(3), 720–36.

Butters, G. (1977): Equilibrium distributions of sales and advertising prices, *Review of Economic Studies*, 44, 465-491.

Filistrucchi, L. et al. (2010). Mergers in two-sided markets – a report to the NMa, Tilburg University.

Gabszewicz, J. J. and X. Y. Wauthy (2003): The option of joint purchase in vertically differentiated markets. *Economic Theory*, 22(4), 817–829.

Gentzkow, M. (2007): Valuing new goods in a model with complementarity: Online newspapers. *American Economic Review*, 97(3), 713 - 44.

Gentzkow, M. and J. M. Shapiro (2008): Competition and truth in the market for news. *Journal of Economic Perspectives,* 22 (2), 133–154.

Gentzkow, M., J. M. Shapiro, and M. Sinkinson (2014): Competition and ideological diversity: Historical evidence from US newspapers, *American Economic Review*, 104(10), 3073–3114.

George, L. M. and F. Oberholzer-Gee (2011): Diversity in local television news. FTC, May 2011.

George, L. M. (2007): What's fit to print: The effect of ownership concentration on product variety in daily newspaper markets. *Information Economics and Policy* 19 (3-4), 285-303.

Grossman, G. and C. Shapiro (1984): Informative advertising with differentiated products, *Review of Economic Studies*, 51, 63-81.

Hotelling, H. (1929): Stability in Competition. *Economic Journal,* 39, 41-57.

Hurkens, S. and Á. L. López, (2014): Mobile Termination, Network Externalities and Consumer Expectations. *The Economic Journal*, 124, 1005–1039.

Jeziorski, P. (2014): Effects of mergers in two-sided markets: The U.S. radio industry. *American Economic Journal: Microeconomics*, 6(4), 35-73.

Katz, M. and C. Shapiro (1985): Network externalities, competition, and compatibility', *American Economic Review*, 75(3), 424–40.

Mullainathan, S. and A. Shleifer (2005): The market for news. *American Economic Review*, 95(4), 1031-1053.

Ofcom (2014): The communications market report, published 7th August 2014.

Peitz, M. and M. Reisinger (2015): The economics of internet media. In Anderson, S. D. Stromberg, and J. Waldfogel, *Handbook of Media Economics*, Elsevier Science.

Peitz, M. and T. Valletti (2008): Content and advertising in the media: Pay-tv versus free-to-air. *International Journal of Industrial Organization*, 26, 949-965.

Reisinger, M. (2012): Platform competition for advertisers and users in media markets. *International Journal of Industrial Organization*, 30(3), 243-252.

Spence, A. M. (1976): Product differentiation and welfare. *American Economic*

Review, 66(2), 407-14.

Steiner, P. O. (1952): Program patterns and the workability of competition in radio broadcasting. *Quarterly Journal of Economics*, 66(2), 194–223.

Stümeier. T. and T. Wenzel (2012): Regulating advertising in the presence of Public Service Broadcasting, *Review of Network Industries*, 111(2), 1-21.

Sweeting, A. (2010): The effects of mergers on product positioning: evidence from the music radio industry. *RAND Journal of Economics*, 41(2), 372–397.

Tirole, J. (1988): *The Theory of Industrial Organization.* Cambridge: MIT Press.

Waldfogel, J. (2009). *The tyranny of the market: Why you can't always get what you want.* Harvard University Press.