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Business models for media firms: Does competition matter for how they raise revenue?

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Business models for media firms: Does competition matter for how they raise revenue?

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Abstract: The purpose of this article is to analyze how competitive forces may influence how media firms like TV channels raise revenue. A media firm can either be financed by advertising revenue, by direct payment from the viewers (or the readers, if we consider newspapers), or by both. It is shown that the less differentiated the media firms' content, the larger is the fraction of their revenue that comes from advertising. If the number of media firms increases, on the other hand, direct payment from the media consumers becomes more important. We also show that advertising prices are strategic substitutes, which implies that competition in advertising prices is distinctly different from price competition in other markets.

1 Introduction

Commercial media firms have chosen various business models for raising revenue. Some TV channels are financed by advertising revenues, while others rely on direct payment from the viewers. Media firms also combine different ways of raising revenue, such as when newspapers earn revenue both from advertising and from direct payment from readers. What determines which business model media firms choose for raising revenue?

The purpose of this article is to show that competition and strategic interactions between media firms may be decisive for their choice of financing. To capture the role of competition, we allow both the degree of content differentiation between the media firms' products and the number of media firms to vary (e.g. the number of newspapers or TV channels). We assume that the media firms choose consumer prices and the ad price per viewer (or per reader, if we consider newspapers) non-cooperatively. We further assume that the media consumers dislike advertising, at least on the margin.[1]

In our analysis we find that the toughness of the competition has an ambiguous effect on the financing of media firms. If the competitive pressure increases because the TV channels offer less differentiated content, they will rely more on advertising revenues. If the number of rivals increases, on the other hand, they will rely more on direct payment from the media consumers.

[1] Even if media consumers dislike advertising on the margin, they may prefer some advertising over none, particularly if we consider informative advertising in newspapers. It is well documented that viewers try to avoid advertising breaks on TV, see Moriarty and Everett (1994) and Danaher (1995). See also Wilbur (2008), who estimates a model of TV competition and finds viewers' disutility to be significant and positive. For printed newspapers, there are less clear answers as to whether consumers consider advertising as a good or a bad, and there are some indications that the extent to which people consider commercials as bad varies across countries. For instance, it has been argued that newspaper readers in Europe have a more negative attitude to advertising than those in the USA (Gabszewicz *et al.*, 2004a). Depken and Wilson's (2004) study of US magazines indicates that readers' attitude to advertising is negative for some magazines and positive for others. Note that this is not inconsistent with our assumption that *on the margin*, consumers dislike advertising.

To understand these results, consider two or more TV channels which are so differentiated that they have (close to) monopoly power in their own viewer segments. This market power can utilized to set high consumer prices. However, if the differentiation between the TV channels is reduced, each will have incentives to lower its consumer price in order to attract viewers from its rivals (demand becomes more elastic). Better substitutability between the channels thereby puts a downward pressure on viewer charges. Actually, they will not be able to set consumer prices higher than marginal costs if the viewers perceive the channels as perfect substitutes (and the firms have equal marginal costs). We therefore arrive at the standard textbook result that revenue from consumer payments is monotonically decreasing in the substitutability between the products.

The same is not true as regards revenue from the advertising market. The reason for this is that the advertisers consider each channel as a bottleneck for accessing that channel's viewers. This means that even undifferentiated TV channels have an individual market power which enables any of them to charge a higher advertising price than its rivals and still face positive demand for advertising. It will thus never be optimal for the media firms to set the advertising price equal to marginal costs. Note also that the benefit of reaching a viewer with an ad is independent of how differentiated the audience considers the TV channels to be. Contrary to what is the case with consumer payments, a smaller channel differentiation will therefore not reduce advertising revenue, other things equal. Indeed, we show that the opposite is true; the less differentiated the channels are from the audience' point of view, the higher the revenue from advertising.

Next, suppose that the number of TV channels increases. The viewers will then be spread out over a larger number of channels, giving each of them a smaller audience. This, in turn, reduces any individual TV channel's market power in the advertising market. As the number of TV channels increases, the price each of them can charge for ads approaches marginal costs. But if the consumers consider the new channels as different from those which are already in the market, each channel will still have some market power in the viewer market, and will therefore always be able to make a positive profit from direct consumer payments. Our model thereby

predicts that consumer payments are a relatively more important source of revenue the larger the number of TV channels.

Our predictions are consistent with casual observations from several media markets. The total number of printed newspapers has gone down the last couple of decades, while at the same time we have witnessed an increase in the number of purely advertising-financed newspapers. This indicates that a reduction in the number of printed newspapers has led to a larger fraction of their revenues being generated by advertising. In the TV market we observe the opposite. The number of commercial TV channels has increased, and direct payments from the viewers have become more and more important relative to advertising revenues. Moreover, as noted by Godes *et al.* (2008), we have witnessed that as the number of online content providers has increased, direct consumer payments on the internet have become more prevalent. Casual observations also indicate that the newspapers and TV channels which are most differentiated from their rivals, are the ones who are best able to charge the consumers. This is most obvious on the internet; a high reliance on ad revenue seems to be the only viable business model for electronic newspapers which cannot offer unique content.

Finally, our model predicts that media firms that are mainly advertising-financed have relatively large audiences. Again, competition is the driving force. To see why, consider two competing TV channels that for some reason have become less differentiated with respect to the content they offer. Then, as argued above, we should expect them to set a lower consumer price and have more ads than what was initially the case. In isolation, the latter has a negative effect on the size of the audience if the public dislikes ads. However, the fact that the channels have become less differentiated also implies that they have lost some market power over the consumers. They must therefore sell their products at more favorable terms, which means that the positive effect of a lower direct charge must dominate over the negative effect of a larger ad volume from the consumers' point of view. Thus, the size of the audience increases. This prediction is consistent with the observation that pay-TV channels and newspapers with few close substitutes typically have high

prices and small audiences.[2]

Several studies of the media industry focus on program scheduling, and, in particular, on the well-known 'lead-in' effect (see, for example, Rust and Eechanbaldi, 1989, and Schachar and Emerson, 2000).[3] Other studies are concerned with the choice of programming, i.e., what programs to produce (see, for example, Liu *et al.*, 2004).[4] However, none of these studies models the choice of advertising by media firms. More recently, there have been some studies that analyze advertising decisions by media firms.[5] The choice of financing - advertising versus direct payment - has not been an issue in these articles.

The only paper we are aware of, besides ours, that considers media firms which are partly financed by advertising and partly by consumer payments, is Godes *et al.* (2008).[6] However, they have a different model set-up and focus. They analyze competition between different media industries, e.g. newspaper and TV, an issue that is not raised in our article. In addition, they analyze duopolistic competition between media firms in the same industry. The unique contribution of their work is to show the impact of competition on the media firms' incentives to underprice

[2]Chae and Flores (1998) analyze how we should expect pay TV and advertising-financed TV to differ on certain main characteristics of the programmes they offer. Their main result is that pay TV tends to show programs for which there is a relatively small audience, but with a high willingness to pay. Advertising-financed TV, on the other hand, focuses on large markets where the audience has a relatively low willingness to pay. Chae and Flores thus focus purely on the demand side to explain how media firms are financed, while we take into account the two-sidedness of the media industries in our analysis.

[3]'Lead-in' refers to TV stations that air popular programs early in the evening to attract viewers who then continue to watch their channels for the rest of the evening. This topic is also studied in Goettler and Schachar (2001) and Rust and Alpert (1984). See also Nilssen and Sørgard (1998), where the program scheduling of news for two competing TV channels is analyzed.

[4]For a debate concerning their results, see Chou and Wu (2006) and Liu *et al.* (2006). Programming has been an issue in the media-economics literature for a long time, see for example Steiner (1952), Beebe (1977) and Spence and Owen (1977).

[5]See Dukes and Gal-Or (2003), Barros et al. (2004), Gabszewicz et al. (2004b), Anderson and Coate (2005), Gal-Or and Dukes (2006) and Kind et al. (2007).

[6]Peitz and Valletti (2008) analyze competition between pay-TV and pure free-to-air in a setting where they assume that the latter cannot charge the viewers.

- i.e., set a low price on contents in order to attract consumers and thereby earn more from advertising. Underpricing can take place in our model as well, but this is not our focus. Instead we set up a model with oligopolistic rather than duopolistic competition, and complement the work by Godes *et al.* by focusing on how the mix between revenues from advertising and direct consumer payment depends on both the number of media products and their substitutability. Additionally, both Godes *et al.* and our paper consider the effect of a change in market structure from monopoly to dupoly. However, it turns out that moving from monopoly to duopoly has qualitatively different effects than those of moving from duopoly to oligopoly.

The rest of the paper is organized as follows. In Section 2 we present our model, and we report our results in Section 3. We first show that while price competition is a harsh form of competition in the consumer market, it is relatively weak in the advertising market. Secondly, we discuss the role of product differentiation and the number of firms in explaining the financing of media firms. Finally, in Section 4, we offer some concluding remarks.

2 The model

We consider a media industry where the media firms choose to earn revenue solely from the advertising market (traditional free-to-air TV and free newspapers), solely from consumer payments (e.g. pure pay-TV), or from a combination of these two sources. There are $m \geq 2$ competing media firms, and each media firm is offering one media product. The advertising level in media product $i = 1, ..., m$ is denoted A_i, and consumer demand is denoted C_i. The advertisers and consumers are charged unit prices equal to r_i and p_i, respectively. We disregard any production costs, such that the profit level of media firm i is

$$\Pi_i = p_i C_i + r_i A_i, \quad i = 1, .., m. \tag{1}$$

There is a continuum of identical consumers with measure one, and we follow Kind *et al.* (2007) in assuming that consumer preferences are given by the Shubik-

Levitan utility function (see Shubik and Levitan, 1980):

$$U = \sum_{i=1}^{m} C_i - \frac{1}{2}\left[m\left(1-s\right)\sum_{i=1}^{m}\left(C_i\right)^2 + s\left(\sum_{i=1}^{m} C_i\right)^2\right]. \tag{2}$$

The parameter $s \in [0,1)$ is a measure of product differentiation: The higher s, the closer substitutes the media products are from the consumers' point of view. The Shubik-Levitan formulation ensures that the parameter s only captures product differentiation and has no effect on market size.[7]

Consumer surplus depends on the price p_i that the consumers are charged for the media product (e.g. per copy of a newspaper). In addition it depends on the level of advertising, unless the consumers are indifferent to ads. To capture this dependency, we let the subjective consumer cost for each unit of media product i be $(p_i + \gamma_i A_i)$, where γ_i measures the consumers' disutility of the ads. Consumer surplus is thus given by

$$CS = U - \sum_{i=1}^{m}\left(p_i + \gamma_i A_i\right) C_i.$$

In principle, γ_i might be a function of the advertising level in media product i. We could for instance assume that consumers have positive utility of ads ($\gamma_i < 0$) for relatively small advertising levels (e.g. because ads inform newspaper readers about retail prices at local stores), but that they perceive ads to be a nuisance if the advertising level becomes sufficiently large. In the former case $\gamma_i A_i$ may be perceived as a negative indirect price for media products i, and in the latter case as a positive indirect price. For the majority of media products it is reasonable to assume that consumers perceive ads as a bad on the margin. In order to highlight the fact that the media firms' choice of direct prices (p_i) and indirect prices ($\gamma_i A_i$) depend crucially on the competitive pressure, we let γ_i be positive and constant, and have the same value for each media product in the industry we consider; $\gamma_i \equiv \gamma \vee i$.[8]

[7] Note that this is in contrast to the standard quadratic utility function, where the same parameter measures both product differentiation and market size. See Motta (2004) for details.

[8] Our framework is not well suited for analyzing competition between different media industries.

By setting $dCS/dC_i = 0$, we then find that consumer demand for media product i equals

$$C_i = \frac{1}{m}\left[1 - \gamma\frac{A_i - s\overline{A}}{1-s} - \frac{p_i - s\overline{p}}{1-s}\right], \quad i = 1, ..., m, \tag{3}$$

where $\overline{A} = \frac{1}{m}\sum_{i=1}^{m} A_i$ is the average level of advertising in the m media products, and $\overline{p} = \frac{1}{m}\sum_{i=1}^{m} p_i$ is the average (direct) consumer price. Demand for media product i is thus decreasing in its own price and advertising level, and increasing in those of its rivals. This reflects the fact that the consumers perceive the media products as (imperfect) substitutes if $s > 0$.

Without loss of generality, we choose unit size of advertising A_i such that $\gamma = 1$. Note that we then have $dC_i/dA_i = dC_i/dp_i < 0$; other things equal, sales of media product i will fall by the same amount whether the indirect price (A_i) or the direct price (p_i) increases by one unit. We nonetheless show that increased competition between media firms will affect their choices of direct and indirect prices qualitatively differently.

The media firms can raise advertising revenue by selling advertising space to producers of consumer goods. There are n potential advertisers, and we let $A_{ik} \geq 0$ denote producer k's advertising level in media product i. A producer's gross gain from advertising is naturally increasing in its advertising level and in the number of media consumers exposed to its advertising. We keep it simple by assuming that the gross gain equals $\eta A_{ik} C_i$, where $\eta > 0$ measures the strength of the producer's benefit from advertising. This implies that the net gain for advertiser k from advertising in media product i equals

$$\pi_k = \left(\eta\sum_{i=1}^{m} A_{ik}C_i\right) - \left(\sum_{i=1}^{m} A_{ik} r_i\right), \quad k = 1, .., n. \tag{4}$$

Below, we consider a two-stage game. At stage 1, the media firms non-cooperatively set advertising prices (r_i) and consumer prices (p_i). At stage 2 the advertisers choose how much advertising space to buy.

It is for instance well known that the disutility of ads (and thus the value of the parameter γ_i in our model) may differ significantly between newspapers and TV. See Godes *et al.* (2008) for an interesting analysis of competition between different media industries.

We solve the game by backward induction. Setting $\partial \pi_k / \partial A_{ik} = 0$ for the n advertisers, taking account of (3), and then using $A_i = \sum_{k=1}^{n} A_{ik}$, we find that demand for advertising at media outlet i equals

$$A_i = \frac{n}{n+1} \frac{1}{\eta} \left[(1 - p_i) \eta - m (1 - s) r_i - ms\overline{r} \right], \quad i = 1, ..., m, \tag{5}$$

where $\overline{r} = \frac{1}{m} \sum_{i=1}^{m} r_i$ is the average advertising price on the m outlets. Note that since $\partial A_i / \partial r_i < 0$, we have a traditional downward-sloping demand curve for ads. We further see that demand for advertising at media firm i is decreasing in its consumer price; $dA_i / dp_i < 0$. This is an indirect effect, which follows from the assumption that consumers have downward-sloping demand functions for each media product. A higher p_i thus reduces consumption of media product i, making it less interesting to advertise in this product.

3 Results

In this section we will apply our model to show how competition may influence how media firms raise revenue. We start out by reporting some results that are crucial for understanding the strategic interaction in this industry.

3.1 The nature of competition

An important insight from the model is that competition on advertising prices is qualitatively different from competition on consumer prices. In particular, equation (5) shows that A_i is decreasing not only in the advertising price charged by media firm i ($\partial A_i / \partial r_i < 0$) but also in the advertising prices charged by the rivals; $\partial A_i / \partial r_j < 0$. To see why, suppose that r_j increases. Then the advertising level at media product j falls, making it relatively more attractive for the audience. Thereby consumption of the rival media products will be reduced (and more so the closer substitutes they are), such that they will observe lower demand for advertising.

We are now ready to note the following crucial property of media competition:

Lemma 1: *Advertising prices are strategic substitutes, whereas consumer prices are strategic complements.*

Proof. By inserting for (3) and (5) into (1), we have

$$\frac{d^2\Pi_i}{dr_i dr_j} = -\frac{n}{n+1}\frac{s}{\eta} < 0, \quad \forall j \neq i.$$

and

$$\frac{d^2\Pi_i}{dp_i dp_j} = \frac{1}{n+1}\frac{1}{m^2}\frac{s}{1-s} > 0, \quad \forall j \neq i.$$

■

Lemma 1 shows that there is an important difference between the two markets in which the media firms operate. In the consumer market, an increase in one firm's price would provide the other firms with incentives to increase their prices too. This is like the normal textbook depiction of price competition. As argued above, things are quite different in the advertising market. If media firm i sets a higher advertising price, it will naturally sell less advertising. However, since advertising is a nuisance to consumers, consumer demand for media product i will increase while consumer demand for rival media products will fall. The rivals will consequently experience a smaller demand for advertising, and thus have incentives to *lower* their advertising prices.[9]

In order to simplify the algebra we shall now make the following assumption:

Assumption: *Let* $n = \infty$ *and* $\eta = 1$.

The consequences of relaxing this assumption are discussed below.

At stage 1, each media firm sets its two prices; one for advertisers and one for consumers. Maximizing channel i's profit in (1), subject to consumer demand in (3) and advertising demand in (5), we have

$$\frac{d\Pi_i}{dr_i} = 1 - 2\left[m\left(1-s\right)+s\right]r_i - s\sum_{j\neq i} r_j; \tag{6}$$

$$\frac{d\Pi_i}{dp_i} = \frac{1}{m^2\left(1-s\right)}\left[m\left(1-s\right) - 2\left(m-s\right)p_i + s\sum_{j\neq i} p_j\right]. \tag{7}$$

[9] This effect seems to be relatively robust, as it appears in a number of different frameworks. See e.g. Nilssen and Sørgard (2001) and Gabszewicz *et al.* (2004b).

Equating (6) and (7) to zero for $i = 1, ..., m$ gives rise to a unique, symmetric equilibrium. By setting $r_i = r$ and $p_i = p \ \forall i$, we find:

$$r = \frac{1}{m(2-s)+s}; \tag{8}$$

$$p = \frac{m(1-s)}{m(2-s)-s}. \tag{9}$$

Let A and C denote advertising and consumption levels at each media firm in the symmetric equilibrium. Inserting from (8) and (9) in (3) and (5) yields:

$$A = \frac{s^2(m-1)}{m^2(2-s)^2 - s^2}; \tag{10}$$

$$C = \frac{1}{m(2-s)+s}. \tag{11}$$

Equilibrium profit for each media firm can now be shown to equal

$$\Pi = \frac{m(1-s)+s}{[m(2-s)+s]^2}. \tag{12}$$

The parameters s and m can be interpreted as measures of competition among the TV stations. If s increases, competition becomes tougher because the media products are less differentiated, while an increase in m implies that competition becomes tougher due to a larger number of media firms. It is therefore not surprising that each media firm's profit is decreasing in both of these parameters ($d\Pi/ds < 0$ and $d\Pi/dm < 0$).[10] However, the relative importance of advertising revenue compared to consumer payments depends crucially on whether competition increases due to an increase in s or m. To see this it is useful first to define S as the share of consumer payments in each media firm's total revenue:

$$S = \frac{pC}{pC + rA}$$

By inserting for prices and quantities we find that

$$S = \frac{(1-s)\,m\,[m(2-s)+s]}{[m(1-s)+s]\,[m(2-s)-s]}. \tag{13}$$

[10] Equation (12) yields $\frac{d\Pi}{dm} = -\frac{m(1-s)(2-s)+s(3-s)}{[m(2-s)+s]^3} < 0$ and $\frac{d\Pi}{ds} = -\frac{s(m-1)^2}{[m(2-s)+s]^3} < 0$.

3.2 The role of product differentiation

Lemma 1 showed that consumer payments are strategic complements, and advertising prices strategic substitutes. This has important implications for how competition between media firms works. Competition in strategic complements is more aggressive than competition in strategic substitutes, and more so the less differentiated the services are (*e.g.*, Bulow, *et al.*, 1985, and Vives, 1999). Intuitively, we should therefore expect the media firms to rely more on advertising revenue and less on consumer payments the closer substitutes the consumers perceive the media products to be (the higher s is). This intuition is straight forwardly verified by noting that equation (13) yields

$$\frac{dS}{ds} = -\frac{ms\left(m-1\right)\left[m\left(4-3s\right)+s\right]}{\left[m\left(1-s\right)+s\right]^2\left[m\left(2-s\right)-s\right]^2} < 0. \tag{14}$$

We can thus state our first main result:

Proposition 1: *The share of consumer payment in the media firms' total revenue is smaller the less differentiated the media products are ($dS/ds < 0$).*

Figure 1 illustrates Proposition 1 for $m = 2$. With our assumption that $\eta = 1$, the gains from selling advertising space are so low compared to the consumers' distaste for ads that a monopoly media firm would prefer to be advertising-free. At $s = 0$ the media firms thus raise all their revenue from consumer payments ($A = 0$ from equation (10)). However, the closer substitutes the media products, the more the media firms will have to rely on the advertising market to raise revenue. If $s = 1$ the media products are perceived as perfect substitutes. At this extreme, they are unable to charge a price higher than marginal costs on the consumer side of the market ($p = 0$ from equation (9)). This follows directly from the result that consumer prices are strategic complements (and the assumption that all media firms have the same marginal costs, which we have set equal to zero). However, since advertising prices are strategic substitutes, the media firms are able to earn a positive profit in the advertising market even at $s = 1$.

What if the media firms were able to compete in advertising quantities instead of advertising prices, i.e. if they can make credible ad quantity commitments?

Then they would compete in strategic complements also on the advertising side of the market. Since this is harsher than competition in strategic substitutes, they will - not surprisingly - have no incentives to make such commitments.[11] On the contrary, if the media firms were able to choose between setting advertising prices and advertising quantities, it would be a dominant strategy for each firms to compete in advertising prices.[12]

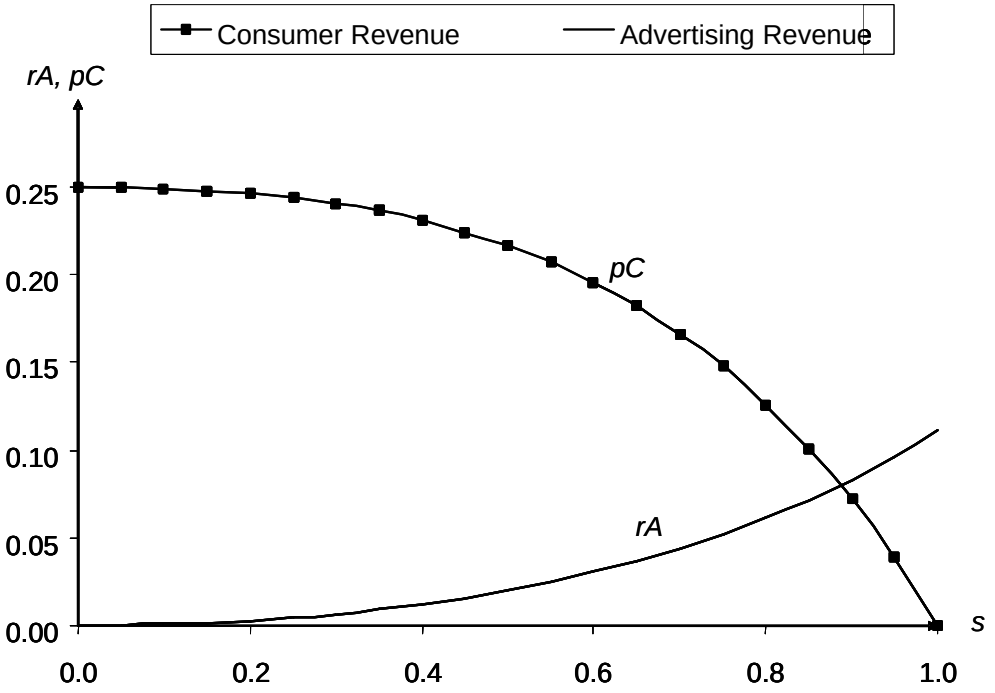

Figure 1: *Revenue from consumers and advertisers.*

A few words on how Assumption 1 affects our results may be warranted. First, the smaller η is, the less profitable is clearly the advertising market for the media firms. Second, it should be noted that n (the number of advertisers) can be interpreted as a proxy for the media firms' market power over the advertisers - the

[11] See the Appendix for a proof with $m = 2$.

[12] Godes *et al.* (2008) assume that the advertisers as well as the consumers perceive the media products as imperfect substitutes. They show that such an assumption might imply that competition in the advertising market is weaker than in the consumer market even if the media firms compete in advertising quantities. More specifically, they show that this is true if $\gamma > h$, where their parameters γ and h measure the degree of product differentiation in the content and the advertiser market, respectively.

smaller n is, the less able the media firms are to extract the profit that advertising generates. Both a lower value of η and a smaller n thus reduce advertising revenue for the media firms. It nonetheless remains true that as s approaches one, the media firms can make profit only from the ad market. Letting $\eta < 1$ and $n < \infty$ would thus neither change the result that the media firms prefer to be advertising free as monopolies nor that they must rely solely on ad revenue if they are perceived as perfect substitutes.

With $\eta > 1$, we must distinguish between two cases. If η is above a critical value η^{crit}, we reach a corner solution where the media firms are raising all their revenues from advertising, no matter how poor substitutes the media products are. This corresponds to the underpricing result in Godes *et.al.* (2008).[13] If $1 < \eta < \eta^{crit}$, on the other hand, the media firms will make profits from both the advertising and the consumer side of the market for any $s \in [0, 1)$. Proposition 1 still holds, though - advertising revenue is relatively more important for the media firms the higher s is. In this respect, Assumption 1 is innocent for our qualitative results.

Before ending this section, we should note that equation (11) yields $dC/ds = (m-1)\left[m\left(2-s\right)+s\right]^{-2} > 0$. This implies:

Corollary 1: *Other things equal, consumption of each media product is larger the closer substitutes they are:* $dC/ds > 0, i = 1, 2$.

To understand the intuition for Corollary 1, note that consumption of each media product is affected in two opposing ways as s increases: Consumer prices go down, and this has a positive impact on the size of the audiences. At the same time, advertising goes up. In isolation, this tends to reduce the sales of the media products. However, the former effect dominates. The reason for this is simply that an increase in s means that competition increases, such that the media firms' ability to utilize their market power over the consumer is reduced. Thereby the size of the audiences is unambiguously higher the closer substitutes the media firms produce, as stated in Corollary 1. This result is similar to what we typically find in traditional (one-sided)

[13] See also Kind, Nilssen and Sørgard (2005), an earlier version of this paper, where it is shown that underpricing can be present even with a monopoly media firm.

markets.

In combination, Proposition 1 and Corollary 1 predict that media firms that are mainly advertising financed have relatively large audiences. However, this is not because they seek a broader audience as such. On the contrary, a media firm with large market power would in our model choose high user payments and accept a relatively small audience. This fits well with the observation that pay-TV channels and newspapers with few close substitutes typically have high prices and small audiences. By the same token, one observes that electronic newspapers with unique contents are able to charge their visitors directly, but that this reduces the number of readers.[14]

Godes *et al.* (op cit) assume that $m \leq 2$, and interpret a change of market structure from monopoly to duopoly as though s changes from zero to a strictly positive number.[15] We agree that this is a reasonable interpretation, since each media firm has monopoly power if $s = 0$ but not if $s > 0$. Consistent with this, we find

$$S(m=2) - S(m=1) = -\frac{s^2}{(4-3s)(2-s)} < 0 \text{ for } s > 0, \tag{15}$$

which means that $sign\left[dS/ds\right] = sign\left[S(m=2) - S(m=1)\right] < 0$ if the media products are imperfect substitutes.

We can state:

Corollary 2: *Let $m = 2$, and assume that the market structure changes from monopoly ($s = 0$) to duopoly ($s > 0$). Then the relative importance of advertising revenue increases.*

Note that $S(m = 2) - S(m = 1) = 0$ if $s = 0$. Whether we have one or two media firms thus does not matter *per se* for the choice of business model. This is true both in our model and in Godes *et al.* What matters is instead whether there is competition between the media firms. If they compete as duopolists, they will rely relatively more on advertising revenue than if each of them had monopoly power

[14] This effect would not show up in a standard Hotelling framework, where the total number of consumers is given. See also the discussion in Section 4.

[15] In their notation, this amounts to changing from $\gamma = 0$ to $\gamma > 0$.

in its own market segment. However, as demonstrated below, we cannot generalize from Corollary 2 that the relative importance of advertising revenue is increasing in the number of competing media firms.

3.3 The role of the number of media products

The results above show that media firms face weaker competition on the advertising side of the market than on the consumer side. On this background, it might be tempting to conclude that both an increase in the number of rivals and in the substitutability between media products will make advertising revenue relatively more important for the media firms. This is not correct, however. The reason is that the larger the number of TV channels, say, the smaller is each channel's audience and thus its market power in the advertising market. This implies that the advertising price will move towards marginal costs as the number of TV channels increases. In the limit we find from equation (8) that

$$\lim_{m\to\infty} r = 0. \tag{16}$$

In contrast, the consumers perceive the media products as imperfect substitutes as long as $s < 1$. The media firms will therefore have some market power over the consumers, no matter how many media products there are on the market. This is formally verified from equation (9):

$$\lim_{m\to\infty} p = \frac{1-s}{2-s} > 0 \text{ for } s < 1. \tag{17}$$

Equations (16) and (17) suggest that as the number of media firms increases, they will to an increasingly large extent have to rely on direct charges from the consumers. We can state our second main result:

Proposition 2: *Assume that* $m \geq 2$ *and* $s \in (0,1)$. *Then the share of consumer payment in each media firm's total revenue is higher the larger the number of rivals*; $dS/dm > 0$.

Proof. From equation (13) we find

$$\frac{dS}{dm} = \frac{s^2(1-s)\left[m(m-2)(2-s)-s\right]}{\left[m(1-s)+s\right]^2\left[m(2-s)-s\right]^2} > 0,$$

where the inequality can be shown to hold for all $s \in (0,1)$ and $m \geq 3$. Inserting for $m = 2$ and $m = 3$ into (13) we further have

$$S(m=3) - S(m=2) = \frac{s^2 (1-s)^2}{(3-2s)^2 (2-s)(4-3s)} > 0 \text{ for } s \in (0,1).$$

■

As noted in the Introduction, the number of TV channels has increased sharply over the last decades, while the opposite is true for newspapers. Proposition 2 is thus consistent with the observation that consumer payments have become increasingly more important for the former, and advertising revenue for the latter. The Proposition is also consistent with the observation of Godes *et al.* (2008) that as the number of content providers has increased on the internet, we have witnessed more and more pay-for-content sites. One recent example is the Norwegian internet broadcaster *TV2 Sumo*, which charges consumers a fee for access to its unique content.[16]

It could be argued that technological progress is the main reason why TV channels now rely more on consumer payments than they used to do. We certainly agree with that claim; it is only with the advent of encrypted digital signals that it has become possible for TV channels to charge their viewers directly (and it is digital transmission technologies which have allowed the large increase in the number of TV channels). However, our model suggests that digitalization of TV signals and basic economic forces might be complementary factors in explaining the growth of pay-TV.

Clearly, there is reason to believe that the growth of internet newspapers has reduced demand for printed newspapers. In this sense it is not surprising that the number of printed newspapers has declined, raising their dependence on advertising revenue according to our model. Furthermore, the mechanisms we have highlighted suggest that their tendency to rely on advertising revenue should increase the better substitutes the readers consider printed and electronic newspapers to be. However, a further analysis of this issue requires a more elaborate model, which takes into

[16] *TV2 Sumo* offers a menu of tariffs, where you can subscribe either weekly, montly or annually or simply pay for watching one particular program. For details, see http://webtv.tv2.no/webtv/.

consideration the specific characteristics of the two kinds of newspapers, and the competitive forces within and between these two market segments. There is also a need for empirical work to analyze how the internet has reduced the willingness to pay for ads in traditional newspapers relative to the readers' willingness to pay for printed media.

4 Some concluding remarks

The main purpose of this paper is to show how competitive forces may affect the way media firms raise revenue. It turns out that competition has an ambiguous effect on the choice of business model. Tougher competition in the sense of closer substitutability between the media products makes advertising revenue relatively more important, while a larger number of media products (e.g. a larger number of TV channels) increases the relative importance of direct payment from the audience.

Our analysis shows that competition in media markets differs from what we observe in most other industries. More specifically, the two-sided nature of media markets implies that competition in consumer prices is qualitatively different from competition in advertising prices. As is the case in more traditional markets, consumer prices are strategic complements: if one media firm reduces the price it charges from its audience, it will be optimal for the other firms to do the same. Advertising prices, on the other hand, are strategic substitutes; a price reduction from one firm leads to a price *increase* from the others. Competition in strategic complements is generally more aggressive than competition in strategic substitutes, and more so the less differentiated the products (see Bulow et al., 1985, and Vives, 1999). This explains why we arrive at the result that the closer substitutes the competing media firms' products are, the larger is the fraction of their revenue that comes from advertising.

A first crucial assumption underlying our results is that the media firms compete in prices towards the consumers. This is hardly controversial. More controversial, though, may our assumption that media firms compete in advertising prices be. It could be argued that it is more reasonable to assume that media firms set adver-

tising quantities rather than advertising prices. First, media firms can presumably relatively easily commit themselves with respect to how much space to allocate to commercials. Second, media firms may *plan* in terms of quantities: how many pages of advertising should there be in a newspaper, and how often should a television program be interrupted by commercials? In practice, however, there are no physical limits to how much space media firms can use for advertising. Thus, the firms need to communicate possibly self-imposed quantity limits to the market. But what we typically observe is announcement of advertising prices only; it is not common for printed newspapers to commit to a maximum number of pages with advertising, or for TV channels to commit to a maximum amount of time for commercials per day.[17] Nor do we observe advertisers pay a lower price the more total advertising there is at a media firm, which could be an indirect way of committing to a 'low' advertising volume. The advertising-price scheme is rather based on, for instance, the size of the audience and the number of minutes the commercial of a given advertiser is shown.

Godes *et al.* (2008) provide some examples where media firms signal that their advertising volume will be relatively low. If these signals are credible, the media firms may end up competing in advertising quantities. However, since competition in strategic substitutes is weaker than competition in strategic complements, it is a dominant strategy in our model for the media firms to compete in advertising prices rather than advertising quantities. Thus, the firms will not have incentives to make non-reversible commitments with respect to advertising quantities. Future empirical and theoretical research should analyze how robust this conclusion is. The observation that internet newspapers and tv channels which do not offer unique content typically are advertising-financed, supports our prediction that they compete in strategic substitutes on the advertising side.[18]

Finally, it should be noted that our model may be considered as a complement to research papers on media economics that build on Hotelling and Salop frame-

[17] However, in some European countries, there is an upper, regulatory limit on how much advertising there can be on TV.

[18] Godes *et al.* (op. cit) show that if advertisers perceive e.g. different TV channels as more differentiated than do the viewers, competition on the advertising side may still be relatively weak even with quantity competition.

works.[19] The advantage of the Hotelling framework is that it makes it possible to endogenize the extent of horizontal differentiation between the media products. However, a disadvantage of both Hotelling and Salop is that the size of the market is typically given, such that aggregate output is independent of whether there is any competition. In our framework, competition leads to higher output, and we believe that this is a reasonable prediction both in the media industry and in other markets. The main motivation for our choice of framework, however, is that it allows us to analyze the consequences of market entry.

5 Appendix

On the dominance of competing in advertising prices

It seems unreasonable to assume that the media firms compete in quantities on the consumer side. We will thus prove that it is a dominant strategy for the media firms to compete in advertising prices instead of advertising quantities, given that they compete in prices on the consumer side.

Assume that there are two media firms; $m = 2$. If both compete in advertising prices, we find from equation (12) that the profit level of each firm is equal to (with superscripts indicating the media firms' choice variables on the ad side of the market)

$$\Pi_i^{r_1,r_2} = \frac{2-s}{(4-s)^2}. \tag{18}$$

Suppose that media firm 1 deviates, and chooses advertising quantity as strategic variable (the results would be symmetric if instead we assumed that the rival deviated). Solving $\{p_1, A_1\} = \arg\max \Pi_1$ and $\{p_2, r_2\} = \arg\max \Pi_2$ we find $p_1 = p_2 = \frac{2(1-s)}{4-3s}, r_2 = \frac{4-3s}{16(1-s)+s^2}$ and $A_1 = \frac{4s^2(1-s)}{(4-3s)(16(1-s)+s^2)}$. The media firms will then have the following profit levels:

$$\Pi_1^{A_1,r_2} = \frac{4(1-s)^2(4-s)^2}{(2-s)\left[16(1-s)+s^2\right]^2} \text{ and } \Pi_2^{A_1,r_2} = \frac{4(1-s)(4-3s)^2}{(2-s)\left[16(1-s)+s^2\right]^2}. \tag{19}$$

Since

$$\Pi_1^{A_1,r_2} - \Pi_1^{r_1,r_2} = -s^3 \frac{4(4-3s)^2 - 3s^3}{(2-s)(4-s)^2\left(16(1-s)+s^2\right)^2} < 0 \text{ for } s > 0,$$

[19] See e.g. Anderson and Coate (2005), Gabszewicz *et al* (2004a, 2004b), and Liu *et al* (2004).

it is not profitable for media firm 1 to deviate from an outcome where both firms compete in advertising prices.

Suppose next that both firms compete in advertising quantities. Solving $\{p_1, A_1\} = \arg\max \Pi_1$ and $\{p_2, A_2\} = \arg\max \Pi_2$ implies that neither of the media firms will have any advertising, and that $p_1 = p_2 = \frac{2(1-s)}{4-3s}$.[20] The firms then make profits equal to

$$\Pi_i^{A_1,A_2} = \frac{(1-s)(2-s)}{(4-3s)^2}.$$

If media firm 2 deviates and chooses advertising price as strategic variable, we can solve $\{p_1, A_1\} = \arg\max \Pi_1$ and $\{p_2, r_2\} = \arg\max \Pi_2$ to find that $\Pi_1^{A_1,r_2}$ and $\Pi_2^{r_2,A_1}$ are given by equation (19). Since $\Pi_2^{A_1,r_2} - \Pi_2^{A_1,A_2} > 0$, it is profitable for media firm 2 to deviate.

Summing up, it follows that it is a dominant strategy for both firms to choose price rather than quantity as the strategic variable in the advertising market. Q.E.D.

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[20] With η sufficiently larger than γ we will have $A_i > 0$, but this does not change the result that it is less profitable to compete in advertising quantities than in advertising prices.

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