Financing of Media Firms: Does Competition Matter?

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Abstract: This paper analyses how competition between media firms influences the way they are financed. In a setting where a monopoly media firm chooses to be completely financed by consumer payments, competition may lead the media firms to be financed by advertising as well. This way, competition endogenously creates a two-sided market, with the media firms as platforms between the audience and the advertisers. The closer substitutes the media firms’ products are, the less they rely on consumer payment and the more they invest in programming. If their products are sufficiently close substitutes, then they commit to being purely financed by advertising, which leads to a downward shift in programming investments.

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1 Introduction

Media firms can generate revenues in various ways. For example, some TV channels are financed by advertising income, while others rely on direct payment from their viewers. Media firms may also combine different ways to raise revenues. For instance, many newspapers earn revenues from both advertising and from consumer payment. Why do media firms choose different ways to earn revenues? And why do we often observe purely advertising-financed media firms, even though empirical evidence suggests that their audiences dislike commercials?\footnote{It is documented that viewers try to escape from advertising breaks on TV, see, \textit{e.g.}, Moriarty and Everett (1994) and Danaher (1995). For printed newspapers, there are less clear answers as to whether consumers consider advertising as a good or as a bad, and we have 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 has a more negative attitude to advertising than those in the USA. See Gabszewicz, \textit{et al.} (2004) for a discussion and references.} Why not charge the audience directly, and avoid product-damaging commercials? In answering these questions, we present a simple model that shows how competition between media firms can help explain how they are financed. We also demonstrate how competition can create a two-sided market, with media firms as platforms between media consumers and advertisers.

To analyze the importance of the rivalry between media firms, we consider a model of a media market where the audience dislikes advertising, but where, at the same time, the media firms may make ”quality investments”, \textit{i.e.}, investments to make their products more attractive to the audience. The firms operating in the market can for instance be TV channels, radio channels, or newspapers (printed or electronic). Each firm is financed by advertising, direct payment from the consumers, or both.

We start out by presenting a benchmark where the market is a monopoly. The media monopolist maximizes its profits by being advertising-free. Otherwise, it would reduce the value of its product for its viewers, who dislike advertising. Revenue is rather raised by charging the viewers directly. In the monopoly case, we therefore have a traditional one-sided market, with the consumer price being set...
such that marginal revenue equals marginal costs.

In a duopoly, in contrast, there is competition between the media firms, and this endogenously creates a two-sided market structure. More specifically, the media firms will now be financed partly by advertising revenue and partly by consumer payments. We find that the closer substitutes their products are, the more will the media firms rely on advertising revenues. Indeed, in the limit as the products become perfect substitutes, the consumer price (and not marginal revenue) will be equal to marginal costs, so that the whole profit comes from advertising.

In order to understand this result, note 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 media firm 1 reduces the price it charges from its audience, it will be optimal for media firm 2 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 other. To see why, suppose that firm 1 reduces its advertising price. This leads to an increase in its level of advertising, which is bad for its audience. Therefore, there will be a shift of media consumers from firm 1 to firm 2, which therefore will end up with a larger audience and therefore can increase its advertising price.

Competition in strategic complements is generally more aggressive than competition in strategic substitutes, and more so the less differentiated the products are (see, e.g., Bulow, et al., 1985, and Vives, 1999). In particular, firms producing identical products at identical costs will make a positive profit if they compete in strategic substitutes, but not if they compete in strategic complements. This explains why we arrive at the result that the media firms will raise all their revenues from advertising in the limit as their products become perfect substitutes. The more differentiated

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2 For a discussion of the notion of 'two-sided markets', see Armstrong (2004), Evans (2003a), and Rochet and Tirole (2003).

3 As stated by Evans (2002, p. 17), "the economist’s usual ‘marginal revenue equals marginal cost’ condition does not help us understand why television viewers pay nothing for watching content that was expensive to create or why many newspapers and magazines are distributed for less than the marginal cost of production and distribution."

4 This was first shown by Nilssen and Sørgard (2001).
the products are, however, the more the firms gain from increasing the consumer price. If the products are unrelated, it becomes optimal to set the monopoly price towards the consumers and not allowing any product-damaging advertising.

How will this analysis be affected by the media firms being able to invest in product quality? If a media firm improves the quality of its product, it will become more attractive to the audience, thereby enabling the firm to charge a higher consumer payment and a higher advertising price. In addition to this pure market-expansion effect, there is a business-stealing effect: investments in quality also capture part of the rival’s audience. Since the audience is more prone to shift from a "low-quality" to a "high-quality" media firm, the less (horizontally) differentiated the firms’ products are, the business-stealing effect is strongest for media outlets that are close substitutes.

In our analysis, we allow the media firms to commit, at the outset, to abstaining from consumer payments all together so that they will be purely advertising-financed. Such an ability to commit seems reasonable in light of the process involved for a media firm in order to make consumer payments feasible. When we allow for quality investments, it may be profitable for the firms to make such a commitment to zero consumer payment. This is in sharp contrast to the optimal strategy for a monopolist, who would prefer to be advertising-free and raise revenue only through user payment. This difference stems from the media firms, all else equal, competing more fiercely on quality investments the closer substitutes their products are. To dampen this cost-intensive rivalry from a close substitute, each of the media firms therefore chooses to commit to being purely advertising financed, this way reducing quality investments and still attracting consumers by giving them free access to the media product. It turns out that quality investments reach a maximum at an intermediate level of product differentiation, where the media firms are financed both by advertising and consumer payments. If the media products become closer substitutes than that critical level, the firms switch to being purely advertising-financed.

The question of why advertising revenue is important to many media firms has

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5This include invoicing and distribution for newspapers, coding of signals and distribution of decoders for TV stations, and payment facilities for websites, etc.
received a lot of attention lately. One reason which has been put forward, is that it may be impossible or at least difficult to collect money from the public in some cases. This has been used as an explanation of why so few newspapers on the Internet are financed by user payment, and why so many broadcasting firms historically have relied heavily on advertising income. However, as argued by Armstrong (2004), technological progress and new payment systems presumably make this a less important reason now than it was earlier. Another explanation may be that the efficiency gains of advertising can be large compared to consumers’ disutility of being interrupted by commercials. In such a case, firms may have a relatively high willingness to pay for advertising, and a media firm may find it profitable to sell advertising space even if this should make the media firm’s product less attractive for the consumers. Not only can this make it profitable for media firms to be financed by a mix of advertising and consumer payments; it may also imply that advertising is socially beneficial even if consumers consider it as a nuisance. Indeed, the level of advertising may be too small from a social point of view if the producers’ gains from advertising are sufficiently large, as noted by Anderson and Coate (2000), Kind, et al. (2003), and Armstrong (2004). This result also shows up in Anderson (2003), where it is assumed that consumers differ with respect to their dislike for commercials. Moreover, Anderson shows that pay TV and advertising financed TV may coexist, where the viewers with the greatest dislike for ads watch the pay system.

There is a small literature focusing, like we do, on the financing of media firms. In Chae and Flores (1998), the financing is exogenously given, and the authors discuss how we should expect pay TV and advertising-financed TV to differ on certain main characteristics of the programs offered. 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. Also in Wurff and Cuilenburg (2001), the financing is exogenously given. These authors analyze the

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6 One example of a channel with mixed financing is Eurosport, which cable-TV companies have to pay a fee to get access to. At the same time Eurosport certainly has its share of commercial breaks.
welfare implications of competition between media firms that may provide a variety of programs to heterogeneous consumers. Their main result is that some competition between media firms is beneficial, in the sense that it creates more diversity, but that competition above a certain threshold is ”ruinous” and leads to excessive sameness.

A paper which is particularly interesting is Godes, et al. (2003), where the financing of media firms is endogenously determined. However, the set-up and focus in that paper are different from ours. In particular, the authors assume that the media firms compete in advertising levels, and they analyze competition between different media industries (e.g., newspaper and TV). Media firms within a given industry are assumed to be homogenous, and in the benchmark model, the consumers are indifferent to the level of advertising. In an extension, they allow the various media industries to differ with respect to the consumers’ disutility of advertising, so that, for instance, commercials on TV are perceived to be more negative than commercials in newspapers. This is an interesting path of research, which we think deserves more attention.

Our analysis is closely related to the literature on two-sided markets, and we contribute to this literature by providing a formal analysis of multihoming.7 Evans (2003b:198) states that multihoming will affect both the price level and price structure, but that ”theory and empirics are not far enough advanced to say much more”. In this paper, we show that difference in the kind of competition on the two sides of the market (in our analysis, strategic complements versus strategic substitutes) may be decisive for the pricing schedules. Indeed, we demonstrate that competition by itself may create a two-sided market. Contrary to most of the existing literature, we further find that competition tends to increase the incentives to invest in quality. The reason for this result is that, unlike the commonly used Hotelling-inspired models, we have a multihoming framework where the market is uncovered (i.e., competition and quality investments enlarge the size of the market).

The rest of this paper is organized as follows. Section 2 provides a benchmark to

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7 Multihoming means that at least one side of the market uses more than one platform (intermediary). In our duopoly model, the audience as well as the advertisers use both TV channels as platforms.
illustrate why a monopoly media firm prefers to be advertising-free when consumers dislike commercials, while duopoly is introduced and discussed in Section 3. Sections 4 and 5 contain the equilibrium analysis and deliver the proofs of our main results. Some of the basic assumptions of the model are discussed in the concluding Section 6.

2 Monopoly as a benchmark

Consider a monopoly media firm. The firm’s product could for instance be a TV program, a printed newspaper, or an Internet newspaper. The media consumers will interchangeably be labelled viewers and audiences.

There is a continuum of consumers with measure 1. Denote by \( V \) the demand for the product provided by the media firm, and let a consumer’s (gross) utility be given by

\[
U = V (1 + Q) - \frac{V^2}{2}. \tag{1}
\]

The variable \( Q (\geq 0) \) measures the "quality" of the media product, i.e., features that make the product more attractive to the audience.

Each consumer has to make a direct payment equal to \( p \) per unit of the good (e.g., per copy of a newspaper). The consumer suffers a disutility when being interrupted by commercials, and the presence of advertising can thus be considered as an indirect charge for the media product. To capture this, we let the subjective cost of the media product equal be \( C = (p + A) V \), where \( A \) is the advertising level. Consumer surplus is thus equal to

\[
CS = U - (p + A) V.
\]

Setting \( \partial CS / \partial V = 0 \), we find

\[
V = 1 + Q - p - A. \tag{2}
\]

For the sake of simplicity, we put the media firm’s production costs equal to zero, so that its profit is

\[
\Pi = AR + pV - Q^2, \tag{3}
\]
where \( Q^2 \) is the cost of investing in quality and \( R \) is the price that the media firm charges per advertising slot.

There are \( n \) symmetric consumer-good producers who advertise on the media firm. Let \( A_k \) denote the demand for advertising by producer \( k \). The producer’s gross gain from his advertising is naturally higher, the more he advertises and the more viewers are exposed to this advertising. We make it simple by assuming that the gross gain equals \( A_k V \). The net gain for firm \( k \) of advertising is then

\[
\pi_k = A_k (V - R).
\]  

(4)

We abstract from possible consumer-surplus effects of advertising on the product market.

Each advertiser chooses an advertising level so as to maximize profit. Solving \( \partial \pi_k / \partial A_k = 0 \) for \( k = 1, ..., N \), and using \( A = \sum_{k=1}^{n} A_k \), we find that total demand for advertising is

\[
A = \frac{n}{1 + n} (1 + Q - p - R)
\]  

(5)

The media firm thus faces a higher demand for advertising, the larger the number of advertisers is, indicating that the profitability of an advertising-financed media firm is increasing in the number \( n \) of advertisers. To see this formally, suppose that the media firm is financed by advertising only. Setting \( p = 0 \), and maximizing (3) with respect to \( R \) and \( Q \), we find \( R = 2/3 - 2/[3 (3n + 4)] \) and \( Q = n/(3n + 4) \). This implies that \( A = 2n/(3n + 4) \),

\[
\pi_k = \frac{4}{(4 + 3n)^2}
\]  

(6)

and

\[
\Pi^{p=0} = \frac{1}{3} - \frac{4}{3 (4 + 3n)}.
\]  

(7)

Suppose instead that the media firm is completely financed by consumer payments. Setting \( A = 0 \), and maximizing (10) with respect to \( p \) and \( Q \), we find \( p = 2/3 \), \( Q = 1/3 \) and

\[
\Pi^{A=0} = 1/3.
\]  

(8)
Comparing $\Pi^p=0$ and $\Pi^A=0$ we see that it is more profitable for the media firm to charge the consumers directly than to raise revenue through the advertising market (but the difference is decreasing in $n$). It is further straightforward to show that there does not exist any hybrid form of financing, with the media firm making profits partly from consumer payments and partly from advertising, which is better. The reason for this is that advertising is an indirect way of financing a media firm if consumers dislike commercials; allowing advertising means that the media firm lets the advertisers capture some of the consumers’ willingness to pay for the media product.

We can now state:

**Proposition 1:** A monopoly media firm maximizes profit by being purely financed by consumer payments: $A = 0$ and $p > 0$.

So how can we explain the existence of media firms that are at least partly financed by advertising? Two possibilities discussed above are that it could be expensive to collect the consumer payments, or that the producer gains from advertising are very large relative to the consumer disutility of advertising. In the rest of the paper, we consider two horizontally differentiated media firms and will show how competition may help explain why many media firms - TV channels and printed or electronic newspapers - to a large extent are financed by advertising.

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8 Assume that utility is given by $U = V(1 + Q - \gamma A) - V^2/2$, while the producer gain from advertising is equal to $\eta AV$ (with $\gamma, \eta > 0$). The social net gain from advertising is then equal to $(\eta - \gamma) A$. In the paper we have implicitly assumed that $\eta = \gamma = 1$, but it can be shown that it is unprofitable for the media firm to allow advertising unless $\eta > \eta^* \equiv \left(1 + 1/2 + \frac{2}{n+1}\right) \gamma$. The reason why we must have $\eta$ strictly greater than $\gamma$ to make advertising profitable, is that the producers will capture some of the consumers willingness to pay for the media product (for $n < \infty$). It should be noted that the point is not really whether the advertisers have some market power over the media firm or not. Suppose, for instance, that it is expensive to make commercials - hardly an unrealistic assumption. In that case the net profit of advertiser $k$ may be written as $\Pi_k = \pi_k - C(.)$, where $C(.)$ is the cost of making commercials. Since $\lim_{n,=\infty} \pi_k = 0$ (cf. equation (6)) we must now have $n < \infty$ for the participation constraint $\pi_k \geq 0$ to hold. Thus, for $\gamma = \eta$, it will never be profitable for the media firm to be advertising financed.
3 A duopoly model

We consider now a context with two competing media firms. Consumers’ gross utility is accordingly modified to\(^9\)

\[
U = V_1 (1 + Q_1) + V_2 (1 + Q_2) - \frac{1}{1 + b} \left( \frac{V_1^2}{2} + \frac{V_2^2}{2} + bV_1V_2 \right).
\] (9)

The new parameter in equation (9) is \(b \in [0, 1)\), which measures the degree of horizontal differentiation between the products of the two media firms. The products are completely independent if \(b = 0\), while there is no horizontal differentiation between them in the limit as \(b \to 1\). More generally, the media firms’ products are closer substitutes from the consumers’ point of view, the higher is \(b\).

Since our focus is on how competition leads to media being advertising-financed, we want the model in other respects to be biased against advertising. We therefore assume that there is a single advertiser, \(i.e., n = 1\). With two media firms, the profit of this advertiser is

\[
\pi = A_1V_1 + A_2V_2 - A_1R_1 - A_2R_2,
\] (10)

while the profit of media firm \(i\) equals

\[
\Pi_i = A_iR_i + p_iV_i - Q_i^2.
\] (11)

When \(b = 0\), the media firms are monopolists in independent markets and will choose to be advertising-free, as shown in the previous section. However, we shall see below that competitive forces make the media firms choose to be at least partly financed by advertising. Indeed, if the media firms’ products are sufficiently close substitutes, each of them may find it advantageous to commit to being completely financed by advertising \((p = 0)\). To show this, we will consider the following game:

Stage 1: The media firms simultaneously decide whether they will be purely financed by advertising, or by a combination of consumer payments and advertising.

Stage 2: The media firms simultaneously decide how much to invest in quality.

\(^9\)This specification is identical to the one we used in Kind, \textit{et al.} (2003) and Barros, \textit{et al.} (2004).
Stage 3: The media firms simultaneously decide advertising prices and consumer payments (the latter only unless $p = 0$ was decided at stage 1).

Stage 4: The advertiser chooses how much advertising to buy from each of the two media firms.

Stage 5: Consumers decide how much to consume of each of the two media products.

A decision by a firm at stage 1 to be financed purely by advertising can be considered as a commitment towards its advertisers to give the audience free access to the media product. If the firm does not make any commitment, it will set $p_i \geq 0$ and $R_i \geq 0$ to maximize profit at stage 3. If a commitment to put $p_i = 0$ is made at stage 1, then only $R_i \geq 0$ is left to choose at stage 3.\(^\text{10}\)

We solve the game by backward induction and thus start with the last stage. The crucial game is the one between the two media firms in stages 1 through 3. But we start out with analyzing the two last stages for any history of commitments and prices.

Like in the monopoly case above, consumers suffer a disutility from the presence of advertising, and the consumer surplus equals:

$$CS = U - (p_1 + A_1) V_1 - (p_2 + A_2) V_2,$$

where $U$ is given by (9). Consumers’ demand for the media products, at stage 5, is found by maximizing the consumer surplus with respect to $V_1$ and $V_2$. This yields

$$V_i = 1 - p_i - p_j b \frac{1}{1 - b} - A_i - A_j b \frac{1}{1 - b} + Q_i - Q_j b \frac{1}{1 - b}. \quad (12)$$

Thus, demand for the media product of firm $i$ is decreasing in its own price and advertising level, and increasing in its own quality level. We further see that a firm’s demand is lower, the more attractive the rival firm’s product is: $V_i$ is decreasing in $Q_j$ and increasing in $A_j$ and $p_j$.

\(^{10}\) We disregard here the possibility for a media firm to commit to be advertising-free and therefore purely financed by consumer payment. Our experiments with a more general model where this is allowed indicate that results would be largely unaffected.
To find the demand for advertising at stage 4, we use equations (10) and (12) to solve $\partial \pi / \partial A_1 = \partial \pi / \partial A_2 = 0$, from which we have

$$A_i = \frac{1}{2} \left( 1 - p_i - \frac{R_i + bR_j}{1+b} + Q_i \right).$$

Equation (13) shows that the demand for advertising facing media firm $i$ is increasing in its programme quality and decreasing in its consumer payment and its advertising price. More interesting is the fact that advertising at firm 1 and advertising at firm 2 are complementary goods for the advertiser; in other words, $A_i$ is decreasing also in $R_j$ (for $b > 0$). To see why this is so, note that an increase in firm $j$’s advertising price $R_j$ reduces its level of advertising, $A_j$. This makes the rival firm $i$ relatively less attractive for the audience, and thus also for the advertiser, and so also $A_i$ decreases. This effect is stronger, the closer substitutes the media firms’ products are, and $A_i$ therefore responds more negatively to an increase in $R_j$ the higher is $b$.\footnote{\(1\) It should be noted that this is not due to there being only one advertisers. With an arbitrary number $n$ of advertisers, we find $A_i = \frac{n}{1+n} \left( 1 - p_i - \frac{R_i + R_j b}{1+b} + Q_i \right)$, which is qualitatively similar to equation (13).}

Equation (12) suggests that consumer payments are strategic complements for the media firms, while equation (13) suggests that advertising prices are strategic substitutes. This conjecture is confirmed by using equations (11), (12), and (13) to find that $\frac{\partial^2 \Pi_i}{\partial p_i \partial p_j} = \frac{b}{2(1-b)} > 0$, and $\frac{\partial^2 \Pi_i}{\partial R_i \partial R_j} = -\frac{b}{2(1+b)} < 0$. We therefore have:

**Proposition 2:** Consumer payments are strategic complements and advertising prices are strategic substitutes.

Thus, 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 firm with incentives to increase its price too, like in the normal textbook depiction of price competition. In the advertising market, things are quite opposite: If one firm increases is price, this would lower the demand for advertising for both firms, since the two advertising services are complementary goods, and the other firm would now have an incentive to decrease its own price. This means that...
price competition is much fiercer in the consumer market than in the advertising market.

A firm’s marginal return from an investment in quality increases when \( b \), the degree of competition, increases: When \( b \) is high, consumers switch easily between the media products, and firms therefore have huge incentives to increase the content quality. This fight for the best quality would be considerably dampened if the firm could escape the fierce competition in the consumer market. The only way out for a firm is to commit unilaterally to have a zero consumer payment, thereby having advertising as the only source of revenue. The main result in our analysis is that such a commitment by both firms is the outcome for a sufficiently high \( b \). However, without any fight for quality, there would be no such commitment in equilibrium, even in the limit as the media products tend to become perfect substitutes.

**Proposition 3:** Suppose the media firms are not able to invest in quality, i.e., let \( Q_1 = Q_2 = 0 \).

- The two media firms never commit at stage 1 to zero consumer payments.
- In equilibrium, consumer payments are lower, advertising prices and advertising quantities are higher, and profits are lower, the closer substitutes the media firms’ products are.
- At \( b = 0 \), the media firms are completely financed by consumer payments, while they are completely financed by advertising in the limit as \( b \to 1 \).

**Proposition 4:** Suppose that quality investments are feasible, i.e., let \( Q_1, Q_2 \geq 0 \).

- If \( b > b^* \), where \( b^* \approx 0.78 \), then both media firms commit to being purely advertising-financed. If \( b < b^* \), then none of the two firms commit.
- At \( b = 0 \), the firms are completely financed by consumer payments. As \( b \) increases and the media firms’ products become closer substitutes, consumer payments are reduced, advertising prices and quantities are increased, while
firms’ profits are reduced, until \( b \) reaches \( b^* \), at which point all variables drop discontinuously. As \( b \) increases further towards 1, consumer payments are fixed at zero, quality and advertising prices increase, without gaining the levels they had below \( b^* \), and advertising quantities and profits decrease.

- Advertising quantities and prices as well as quality investments have their maximum values at \( b = b^* \), whereas consumer payments and profits decrease monotonically as \( b \) increases from 0 to 1.

The proofs of the two Propositions are given in the next two Sections. We start out in Section 4 with analyzing the case where firms do not make any quality investments. Thereafter, in Section 5, we introduce quality investments.

The results of Propositions 3 and 4 can be illustrated by graphs, as we do in Figures 1-2. In these figures, we depict the variables that most succinctly summarize our analysis. In Figure 1, we depict the outcome of the game without any quality investments, which is the situation covered by Proposition 3 above. In Figure 2, we illustrate the outcome of the game where quality investments are allowed, which corresponds to Proposition 4 above. In the left panels of the two figures, we graph \( A_iR_i \) and \( p_iV_i \) for each firm. These are the advertising revenue and the consumer-payment revenue, respectively. In the right panel, we depict levels of quality investments and profits. Of course, in the case of no quality investments, illustrated in Figure 1, there are no quality investments to report in the right panel.

Our main finding, which shows up clearly in these Figures, is that an increase in media competition leads to a shift from consumer payments to advertising as a source of revenue. In the case without any quality investments, depicted in Figure 1, there is a steady decrease in consumer-payments revenue as competition gets tougher, i.e., as \( b \) increases. In the case where quality investments are allowed, corresponding to Figure 2, an increase in \( b \) implies an increase in quality investments by the two firms in order to counteract the competitive pressure. This increase in quality leads again to an increase in the media firms’ audiences, \( V_i \), so that, for low \( b \), an increase in the competitive pressure leads to a slight increase in consumer-payments revenue, \( p_iV_i \). However, as a further increase in \( b \) leads to a decrease in \( p_i \), there is eventually
Figure 1: No quality investments.

Figure 2: Endogenous quality investments.
a decrease also in $p_i V_i$, despite a further increase in the audiences. There is a
drastic change in the picture for high values of $b$: The firms choose to commit to
being purely advertising-financed. This leads to a dramatic drop in the incentives
to invest in quality, since a higher quality now cannot benefit directly from the
increased audience it attracts but only indirectly through the implied increase in
the demand for advertising.

Thus, media firms' investments in the quality of their products (programmes,
web-site contents, etc.) are at their peaks for a medium level of competitive pressure.
If the competitive pressure is loosened, then the fight for quality is relaxed and
quality investments go down. If, on the other hand, the competitive pressure is
increased, then the fight for quality gets too tough and the media firms bail out by
committing to abstain from consumer payments, thus decreasing the profitability
of quality investments but at the same time avoiding a quality war that would be
disastrous for profits.

4 No quality investments

Suppose quality is set exogenously at zero in the two media firms. In order to
find out what commitment decisions firms make in stage 1, we need to discuss the
subgames following each of the three distinct outcomes of that stage: none of the
firms commits; one firm commits while the other does not; and both firms commit.

Consider first the case where none of the firms commits. At stage 3, both firms
now decide on both consumer prices and advertising prices. With $Q_1 = Q_2 = 0$, each
firm maximizes profit (11) subject to the audience function (12) and the demand
for advertising (13). We find that the firms set the following prices:

$$R_i = \frac{1 + b}{2 + b}, \quad p_i = \frac{1 - b}{2 - b}. \quad (14)$$

By insertions in (13) and (12), we find that this gives rise to advertising quantities
and audiences equal to
\[ A_i = \frac{b^2}{2(4-b^2)}, \quad V_i = \frac{4+2b-b^2}{2(4-b^2)}. \]  

(15)

Thus, firms’ profits are given by

\[ \Pi_i = \frac{4-3b^2}{(4-b^2)^2}. \]  

(16)

Consider next the case where both firms commit to being purely advertising-financed, so that, in addition to \( Q_1 = Q_2 = 0 \), also \( p_1 = p_2 = 0 \). Firms now set the same advertising price as above, \( i.e.: \)

\[ R_i = \frac{1+b}{2+b}, \quad p_i = 0. \]  

(17)

Advertising quantities and audiences now are:

\[ A_i = \frac{1}{2(2+b)}, \quad V_i = \frac{3+2b}{2(2+b)}, \]

and profits of the two firms equal

\[ \Pi_i = \frac{1+b}{2(2+b)^2}. \]

Finally, we consider the case where one firm, say firm 1, commits to being purely advertising-financed, while firm 2 does not commit. This gives rise to an asymmetric game between the two firms at stage 3. While firm 1 is committed to \( p_1 = 0 \) and therefore has only \( R_1 \) to decide on, firm 2 decides on both prices. We get:

\[ R_1 = \frac{1+b}{2+b}, \quad p_1 = 0; \quad R_2 = \frac{1+b}{2+b}, \quad p_2 = \frac{1-b}{2}. \]

We see that advertising prices are still the same as before. Advertising quantities and audiences for the two firms are:

\[ A_1 = \frac{1}{2(2+b)}, \quad V_1 = \frac{6+6b+b^2}{4(2+b)}; \quad A_2 = \frac{b(1+b)}{4(2+b)}, \quad V_2 = \frac{4+3b}{4(2+b)}. \]

This gives rise to the following profits for the two firms:

\[ \Pi_1 = \frac{1+b}{2(2+b)^2}; \quad \Pi_2 = \frac{8+4b-3b^2-b^3}{8(2+b)^2}. \]
In summary, then, the two firms face the following reduced-form game at stage 1:

<table>
<thead>
<tr>
<th>Firm 1</th>
<th>Firm 2→</th>
<th>Commit</th>
<th>Do not commit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm 1 → Commit</td>
<td>((\frac{1+b}{2(2+b)^2}, \frac{1+b}{2(2+b)^2}))</td>
<td>((\frac{1+b}{2(2+b)^2}, \frac{8+4b-3b^2-b^3}{8(2+b)^2}))</td>
<td></td>
</tr>
<tr>
<td>Do not commit</td>
<td>((\frac{8+4b-3b^2-b^3}{8(2+b)^2}, \frac{1+b}{2(2+b)^2}))</td>
<td>((\frac{1-b^2}{(4-b^2)^2}}, \frac{4-3b^2}{(4-b^2)^2}))</td>
<td></td>
</tr>
</tbody>
</table>

Inspection of this game matrix reveals that, for any \(b \in [0,1)\), there is a unique equilibrium in which none of the firms commit at stage 1.\(^{12}\) Thus, prices and quantities are as detailed in eqs. (14) and (15). This proves Proposition 3.

## 5 Investments in quality

We now allow firms to invest in quality. And again, we discuss the subgames following each of the three distinct outcomes of stage 1: none of the firms commits; one firm commits while the other does not; and both firms commit. The analysis is now complicated by the need to sort out firms’ choices at stage 2, when quality investments are decided upon.

We start out with considering the situation after none of the firms have committed to zero consumer payments at stage 1. We solve stage 3 by maximizing \(\Pi_i\) with respect to \(p_i\) and \(R_i\) \((i = 1, 2)\), subject to (12) and (13). This yields

\[
R_i = \frac{1 + b}{2 + b} \left(1 + \frac{2Q_i - bQ_j}{2 - b}\right),
\]

(18) and

\[
p_i = \frac{1 - b}{2 - b} \left(1 + \frac{(2 - b^2)Q_i - bQ_j}{2 - b^2 - b}\right).
\]

(19) By insertions in (13) and (12), we find that\(^{13}\)

\[
A_i = \frac{b^2}{2(4 - b^2)} (1 + Q_i),
\]

(20)

\(^{12}\)This is an equilibrium in dominating strategies in the stage-1 reduced-form game, since the strategy "Commit" is strictly dominated by the strategy "Do not commit" for all \(b \in [0,1)\):

\[
\frac{1+b}{2(2+b)^2} < \frac{8+4b-3b^2-b^3}{8(2+b)^2}, \text{ and } \frac{1+b}{2(2+b)^2} < \frac{4-3b^2}{(4-b^2)^2}.
\]

\(^{13}\)This implies that the advertising quantity equals zero at \(b = 0\). This is naturally consistent with the result we found in Section 2, since each media firm is a monopolist for \(b = 0\).
and

\[ V_i = \frac{(4 - 3b^2)(1 + Q_i) - b(2 - b^2)(1 + Q_j)}{2(1 - b)(4 - b^2)}. \]  

At stage 2, the two media firms make their decisions on how much to invest in quality. Inserting equations (18) through (21) into (11) and solving the first-order conditions \( \partial \Pi_i / \partial Q_i = 0 \) \((i = 1, 2)\) for the two media firms, we find

\[ Q_i = \frac{8 - 4b - 4b^2 - b^3}{24 - 4b - 12b^2 + b^3 + 2b^4}. \]  

This is the unique symmetric equilibrium for \( b \in [0, b_1) \), where \( b_1 \approx 0.96 \), and firms’ profits are given by:

\[ \Pi_i = \frac{192 - 64b - 272b^2 + 48b^3 + 104b^4 - 8b^5 - 13b^6}{(24 - 4b - 12b^2 + b^3 + 2b^4)^2}. \]  

For \( b \in (b_1, 1) \), there are two symmetric equilibria, one given by (22) and one where both firms choose \( Q_i = 0 \).\(^{14}\) Firms’ profits are higher in the latter equilibrium and, like in (16), given by

\[ \Pi_i = \frac{4 - 3b^2}{(4 - b^2)^2}. \]

Next, we consider the situation after both media firms commit, at stage 1, to put \( p = 0 \), so that the firms will be completely financed by advertising revenue. The advantage of this strategy for a media firm is that it can reduce its investment in quality and still be competitive by granting consumers free access to its product.

We solve for Stages 2 and 3 of the game under the constraint that \( p_i = 0 \) \((i = 1, 2)\). At Stage 3, each firm maximizes \( \Pi_i = A_i R_i - Q_i^2 \) with respect to \( R_i \), subject to (12), (13), and \( p_i = 0 \). Solving simultaneously for \( i = 1, 2 \), we find that the advertising price is still given by equation (18), while the advertising quantity now equals

\(^{14}\)We disregard any asymmetric equilibria in our analysis. For completeness, we report that, for \( b \in (b_2, b_1) \), where \( b_2 \approx 0.87 \), there are, in addition to the symmetric equilibrium reported in (22), also two asymmetric equilibria. In each of these equilibria, one firm chooses \( Q_i = 0 \) and the other one chooses \( Q_j = \frac{(1-b)(8+4b-4b^2-b^3)}{36-64b-24b^2+32b^3+36b^4-4b^5} \). Note that the firms’ decisions on quality investments are strategic substitutes for \( b \in [0, b_1) \) but turn into strategic complements for \( b \in (b_1, 1) \).
Thus, the audience of each firm is:

\[ V_i = \frac{2b + 3}{2b + 4} + \frac{3(2 - b^2)Q_i - b(5 - 2b^2)Q_j}{2(1 - b)(4 - b^2)}. \]  

(25)

At Stage 2, each firm maximizes profit with respect to quality, subject to (18), (24), (25), and \( p_i = 0 \). We find a unique equilibrium for all \( b \in [0, 1) \), given by

\[ Q_i = \frac{1 + b}{15 + 7b - 4b^2 - 2b^3}. \]

Profits for both firms are thus given by:

\[ \Pi_i = \frac{63 + 62b - 33b^2 - 48b^3 - 12b^4}{(15 + 7b - 4b^2 - 2b^3)^2}. \]  

(26)

Consider finally the case where, at stage 1, one firm, say firm 1, commits to zero consumer payments while the other firm 2 does not commit. At Stage 3, each firm maximizes \( \Pi_i = A_iR_i - Q_i^2 \) with respect to \( R_i \), subject to (12) and (13), with the extra restriction \( p_1 = 0 \) for firm 1. This gives rise to advertising prices for the two firms once more given by (18), while the uncommitted firm 2’s consumer price is:

\[ p_2 = \frac{1 - b}{2} \left( 1 + \frac{Q_1 - bQ_2}{1 - b} \right). \]  

(27)

Inserting (18), (27), and \( p_1 = 0 \) into (13), we find the advertising levels of the two firms, for given quality levels from stage 2. Firm 1, which is committed to being purely financed by advertising, has

\[ A_1 = \frac{1}{2(2 + b)} \left( 1 + \frac{2Q_2 - bQ_1}{2 - b} \right), \]

while the uncommitted firm 2, with part of its revenue from consumer payments, has

\[ A_2 = \frac{b(1 + b)}{4(2 + b)} \left( 1 + \frac{bQ_1 + (2 - b^2)Q_2}{b + 2 - b^2} \right). \]

An analysis of the stage-2 game, where the two firms simultaneously choose their levels of quality investments, reveals that, for \( b \in (b^*, 1) \), where \( b^* \approx 0.78 \),
the non-negativity restriction $p_1 \geq 0$ on the uncommitted firm’s price is binding. Thus, for $b \in (b^*, 1)$, the outcome in the case of one committed firm is identical to that of both firms being committed, with both firms’ consumer prices being zero. Furthermore, for $b \in (b^{**}, b^*)$, where $b^* \approx 0.76$, the non-negative constraint $A_2 \geq 0$ on the committed firm’s advertising is binding, implying that this firm de facto is out of business, with revenues neither from consumer payments nor from advertising and the uncommitted firm behaving like a monopolist. For $b \in [0, b^{**})$, this case is distinctly different from the others; expressions for the two firms’ quality levels and profits are found in the Appendix.

Analysis of the stage-1 game has to be done in several steps. Consider first the case where $b \in (b_1, 1)$. When no firms commit, we have a situation with two symmetric equilibria. It turns out that, even if we pick the one with the higher profit per firm, where no firm invests in quality, firms prefer to commit. To see this, note that one firm committing unilaterally moves the game to a situation with de facto both firms committing, by the argument in the previous paragraph. Thus, we need to compare profit from no firm committing, $\frac{4-3b^2}{(4-b^2)^2}$, with that from both firms committing, $\frac{63+62b-33b^2-48b^3-12b^4}{(15+7b-4b^2-2b^3)^2}$, and the latter is higher for all $b \in (b_1, 1)$. Thus, there cannot be an equilibrium where a firm does not commit in this case.

Secondly, consider the case where $b \in (b^*, b_1)$. Also in this case, the outcome when one firm is committed is identical to that when there are two committed firms. Again, the outcome is that both firms committing is the only equilibrium, this time because the expression in (26) is greater than the one in (23) for any $b \in (b^*, b_1)$.

Thirdly, consider the case $b \in (b^{**}, b^*)$. Committing oneself now means earning zero profit, and no firm committing is therefore an equilibrium. At the same time, both firms committing cannot be an equilibrium, since one firm, by instead choosing not to commit, would bring itself into a monopoly situation. Therefore, the unique equilibrium is no firm committing.

Finally, consider the case $b \in (0, b^{**})$. We need to compare the profits of the two firms in the asymmetric case, given in the Appendix, with what the firms can earn when both firms are committed and non-committed, respectively. The outcome of that investigation is that there is a unique equilibrium in this case in which no firm
is committing.

Thus, there is a regime shift at \( b = b^* \). If \( b \) is greater than that, then both firms commit to being purely advertising-financed. If \( b \) is less than that, on the other hand, then none of the firms commits. Proper insertions give the results on prices and quantities reported in Proposition 4, and this Proposition is thus proved.

6 Concluding remarks

The main purpose of this paper is to show that the tougher the competition between media firms is, the more important are advertising revenues likely to be. In order to show this, we set up a very simple model where a media firm, when it is a monopolist, maximizes profit by being financed purely by the audience, but where it ends up being purely financed by advertising when it faces competition from a media firm whose product is close to a perfect substitute. We show that competition between media firms make them invest more in quality, other things equal. However, both quality investments and advertising levels tend to reach a maximum for some intermediate level of competition. When competition becomes even tougher, firms choose to commit to being purely advertising-financed, which shifts down both quality and advertising.

Two crucial assumptions for the above result are that the media firms compete in consumer prices and in advertising prices. The former is hardly controversial, but it could be argued that it is more reasonable to assume that they compete in advertising 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, it may be argued that media firms plan in terms of quantities: how many pages of advertising should there be in a newspaper, and how often should a programme on TV be interrupted by commercials (see Godes, et al., 2003)? In practice, however, there are no physical limits to how much space a media firm can use for advertising. Thus, they need to communicate possibly self-imposed quantity limits to the market. But what we typically observe is announcement of advertising prices only; it is rather uncommon to see that printed newspapers commit to
a maximum number of pages with advertising, or that media firms commit to a maximum time for commercials per day.\footnote{However, in some European countries, there is an upper, regulatory limit on how much advertising there can be on TV; see Kind, \textit{et al.} (2003).} Nor do advertisers pay a lower price, the more advertising there is in total at a media firm (or a newspaper), 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.

The apparent lack of visible advertising-quantity commitments is not surprising from a theoretical point of view. As argued above, advertising prices are strategic substitutes. Advertising quantities, on the other hand, are strategic complements. To see why, consider two Internet newspapers that are financed by utility-decreasing advertising. Suppose that the consumers perceive the newspapers to be intrinsically identical, and that the newspapers compete in advertising quantities. If one of the newspapers has slightly more advertising than the other, then that newspaper will be unattractive for the readers, and thus also for the advertisers. Each newspaper will therefore have an incentive to commit to a lower advertising quantity than the other. The only possible equilibrium would then be one with no advertising and no profit, equivalent to a standard Bertrand price equilibrium in homogenous goods (see Kind, \textit{et al.}, 2003). The result is less extreme if the newspapers are imperfect substitutes, but they will still make a lower profit if they compete in advertising quantities than in advertising prices.\footnote{See Vives (1999) for a general discussion of why price competition may give rise to higher profits than quantity competition when goods are complements.}

In the paper, we have assumed that consumers pay a fixed price per viewing time on TV or per copy of a newspaper, which may be a reasonable approximation to the pricing schedule used on pay-TV and non-subscription newspapers, for instance. It should be noted, though, that many media firms have a fixed monthly or annual fee. An interesting extension of the model would be to consider alternative payment models in order to analyze the robustness of the result that advertising income tends to become more important for media firm the higher the competitive pressure.
7 References


8 Appendix

Quality investments: The case when one firm commits.

Expressions for quality levels and profits, \( b < 0.76 \): to be added.