Two-Sided Network E¤ects and Competition : An Application to Media Industries

Jorge Ferrando, Jean J. Gabszewicz,
Didier Laussel and Nathalie Sonnac
CREST-LEI and EUREQUA
CORE, Université Catholique de Louvain
GREQAM, Université de la Méditerranée
CREST-LEI and Université de Paris II

December 8, 2003

Abstract

Intermarket network externalities take place when the utility of a good produced in a given industry varies with the size of the demand for a good produced in another. A particularly signi…cant example of this phenomenon is provided by the interaction between the media and advertising industries. Media consumers vary according to their willingness to pay for the media good, which depends on the advertising volume. Advertisers vary according to their willingness to pay for an ad, which also depends on the audience reached. We model a situation of competition between two content providers who are rivals in both the media and advertising industries, choosing simultaneously the newspapers prices and the advertising rates. We characterise the equilibria of the game and explore how they depend on audience attitudes towards advertising. Our main …nding is that two-sided interactions may induce exit by one of the media companies from either only the advertising market or both markets.

1 Introduction

Media companies operate between two markets: the media market in which they sell media content to the audience (readers, listeners, viewers) and the advertising market in which they sell a fraction of media support to advertisers. Even if the attitude of media consumers towards advertising cannot be unambiguously ascertained, it is widely recognized that the audience is not neutral to the quantity of advertising contained in the media. Thus, the utility of all agents in the media market, companies and audience, depends on the size of demand in the advertising market. Conversely, the utility of advertisers depends as well on the size of demand in the media market. It is clear, for instance, that the larger the readership of a newspaper, the more an advertiser will be willing to pay for an insert: the impact of the advertising message increases with the size of the audience. Hence, there are two-sided network e¤ects between the media and advertising markets: the size of demand in the latter in‡uences the utility of the agents in the former and vice versa.

Generally, economists interested in network e¤ects analyze them when the consumption externality created by the demand for the good comes from within the industry.[1] Beginning with Katz and Shapiro (1985) there is an extensive literature dealing with these intramarket network externalities. But in some cases, like in the media industries, network e¤ects take place from one market to another: the utility of a good produced in a given market varies with the size of the demand for a good produced in another, and conversely. This is what we call intermarket or two-sided network externalities. These are studied in a more recent strand of literature on platforms and intermediaries, or more generally two-sided markets (see for example Rochet and Tirole (2003) and Armstrong (2002)).

In the media market, it is generally accepted that TV-viewers are reluctant to advertising (Gal-Or and Dukes (2003), Anderson and Coate (2000), Danaher (1995), Brown and Rothschild (1993), among others). However, judgements about readers' attitudes towards printed media advertising are more ambiguous. Some scholars think that advertising could foster the circulation of newspapers while others believe that it slows it down (see Blair and Romano (1993), Gustafsson (1978) or Rosse (1980) for the …rst viewpoint, or Musnick (1999) and Sonnac (2000) for the second). It seems that the e¤ective readership of the printed media industry is made of a mixture of consumers among whom some share a positive perception of press advertising while the remaining ones support the opposite view. But the main point for our purpose is that the utility of the audience is, positively or negatively, related to the size of advertising demand, revealing thereby the existence of intermarket network e¤ects between the media and the advertising markets from the viewpoint of the audience as well.

Gabszewicz et al (2004) show that readers' attitudes towards advertising play a key role in the trade-o¤ the editor faces between the two markets, and determine whether advertising subsidizes newspapers' prices to consumers. They use a monopolistic model representing the two-sided network e¤ects between the advertising and printed media industries with a single editor.

In the present paper, we use a similar framework to focus on the competitive e¤ects of these two-sided interactions. We build a model of two editors competing in both the newspapers' and advertising markets: each chooses si-

[1] A well known example of this situation is provided by telecommunications: the larger the number of consumers connected to the telecom network, the higher the utility of a subscription. An industry in which the good exchanged is submitted to congestion provides another example: the higher the demand, the lower the quality of the product and the willingness to pay of consumers. Goods generating snobbish consumption e¤ects can also be viewed as creating network externalities, since an increase in the number of its consumers decreases the utility obtained from individual consumption (Grilo, Shy and Thisse (2001)). The …rst example corresponds to a positive consumption network externality while the two others to a negative one.

multaneously the price of his newspaper and his advertising rate. To identify the consequences of this competition, we analyze a one-shot game whose players are the editors, each selling a di¤erentiated newspaper to a continuum of customers, like newspapers of di¤erent political content, and advertising space to a continuum of advertisers. Adapting to the study of intermarket network externalities the assumption …rst introduced by Katz and Shapiro (1985) for analyzing intramarket network externalities we suppose that readers and advertisers form expectations about the advertising volumes and the readerships, respectively, before the editors determine their prices in the two markets. This is only in the last stage that readers and advertisers make their purchase decisions. We characterize the ful…lled expectations Bertrand equilibria of this game and explore how they depend on the number of ad-avoiders and ad-lovers, and on the intensity of readers' attraction or repulsion feelings for advertising.

As in the intramarket network externalities model of Katz and Shapiro (1985) asymmetric outcomes must be expected in the advertising and printed media markets, as a result of the asymmetry in beliefs concerning the advertising volumes sold by the editors to advertisers. These asymmetric outcomes are characterized by the fact that the editor who is expected to sell more advertising has higher prices and larger market shares in both markets. Moreover, equilibria are often observed at which one of the editors prevents the entry of his rival by fully monopolizing either the advertising market or both the press and advertising markets. The existence of such equilibria could accordingly give a strong theoretical support to the assertion that the …nancial dependence of the media industry on advertising constitutes one of the major vectors of concentration in this industry.[2]

2 The model

Consider two editors, 1 and 2, selling one newspaper each to a population of readers and selling advertising space to a population of …rms who buy it to promote the sales of their products. Total revenues of the editors accrue from their sales in the printed media market (editorial revenues) and also from their sales of ad space in the advertising market (advertising revenues).[3] Consumers in each market will base their consumption decisions based on the expected demands in the other market. Let d_1^e and d_2^e denote the demands of advertising in each newspaper anticipated by readers and D_1^e and D_2^e denote the readerships of each newspaper as anticipated by the advertisers. We do not explicitly model the process through which consumers expectations are formed, but we will, however, impose the requirement that in equilibrium readers' and advertisers'

[2] Media play a major role in spreading political and social information among the citizens. In a recent paper, Strömberg (2002) uses a general equilibrium model to study the role of the media in democracies from a political economy perspective. Here we take an industrial organization approach.

[3] Except in the cases of public television and radio broadcasting, or the free distribution press, in which there are only advertising revenues.

expectations are fulfilled. Notice that these expectations are supposed to be given: they do not depend on the editor's pricing decisions.[4]

The printed media market Consider a population of readers ranked, between the political opinions expressed in both newspapers (for instance), from the left to the right on the political spectrum $[0;1]$:[5] Newspaper 1 is located on this spectrum at point 0; while editor 2 is located at point 1: At each point t of the unit interval $[0;1]$, there corresponds a continuum $[0;1]$ of readers, with a proportion γ of them being advertising-avoiders and a proportion $1-\gamma$ being advertising-lovers. By this we mean that the advertising-avoiders (resp. lovers) lose (resp. gain) in utility when the surface devoted to advertising inserts increases : the larger the surface of a newspaper sold to advertisers, the larger the loss (resp. gain) in utility incurred when reading that newspaper. The parameter β measures the intensity of ad-attraction when a reader is ad-lover while it measures his intensity of ad-repulsion when he is ad-averse.[6] Hence, for a reader located at a distance t (resp. $1-t$) of the left newspaper who belongs to the proportion γ of advertising-avoiders, total loss in utility when buying this newspaper is measured by

$$t^2 + \beta d_1^e + p_1; \beta > 0$$

(total loss in utility when buying newspaper 2 : $(1-t)^2 + \beta d_2^e + p_2$), when editor 1 (resp. editor 2) quotes a price p_1 (resp. p_2) for his newspaper and is expected by the readers to sell a proportion d_1^e (resp. d_2^e) of it to advertisers.

Similarly, for a reader located at a distance t (resp. $1-t$) of the left newspaper who belongs to the proportion $1-\gamma$ of advertising-lovers, total loss in utility when buying this newspaper is now measured by

$$t^2 - \beta d_1^e + p_1$$

(total loss in utility when buying newspaper 2 : $(1-t)^2 - \beta d_2^e + p_2$), when editor 1 (resp. editor 2) quotes a price p_1 (resp. p_2) and sells a proportion x_1 (resp. x_2) of the newspaper's surface to advertisers. Consequently, the reader t_α for which the equality

$$t^2 + \beta d_1^e + p_1 = (1-t)^2 + \beta d_2^e + p_2$$

holds, i.e.

$$t_\alpha = \frac{1}{2} - \frac{\beta}{2}(d_1^e - d_2^e) + \frac{1}{2}(p_2 - p_1);$$

[4] This assumption is similar to Katz and Shapiro (1985)'s assumption on consumers' predictions of network sizes.

[5] For clarity, we restrict our presentation here to the case of the newsprint industry. For a more general perspective, think of the political opinion as the content mix, the readers as the audience, and the editors as the media content providers (thematic TV channels, for example).

[6] One could suppose instead that each reader is characterized not only by a value of t but also by a value of a parameter of ad-attraction (or ad-aversion if negative) uniformly distributed on some interval including 0. If one supposes that the two distributions are independent this would lead to results identical to those obtained here.

separates those types of ad-avoiders who buy their newspaper from editor 1 from those who buy it from editor 2. Similarly, the reader t_λ for which the equality

$$t^2 - \beta d_1^e + p_1 = (1 - t)^2 - \beta d_2^e + p_2$$

holds, i.e.

$$t_\lambda = \frac{1}{2} + \frac{\beta}{2}(d_1^e - d_2^e) + \frac{1}{2}(p_2 - p_1)$$

separates those types of ad-lovers who buy their newspaper from editor 1 from those who buy it from editor 2. We observe that

$$\begin{aligned} t_\alpha &\leq t_\lambda \Leftrightarrow d_1^e \geq d_2^e \\ t_\lambda - t_\alpha &= \beta(d_1^e - d_2^e). \end{aligned}$$

(insert Figure1)

In order to illustrate the resulting demand functions in the press industry, assume that $d_1^e > d_2^e$. Then $t_\alpha \leq t_\lambda$: all readers at the left of t_α buy newspaper 1, whether being ad-avoiders or ad-lovers ; all those at the right of $1 - t_\lambda$ buy from editor 2, while those between t_α and t_λ who are ad-lovers buy news 1 and those who are ad-avoiders buy in this sub-interval newspaper 2 (see Figure 1). Accordingly, when $d_1^e > d_2^e$, and assuming that both firms have a strictly positive market share, the corresponding demand functions in the newsstand sales market are, respectively, for editor 1

$$D_1(p_1, p_2, d_1^e, d_2^e) = \frac{1}{2} + \frac{1}{2}(p_2 - p_1) + \frac{\beta}{2}(1 - 2\gamma)(d_1^e - d_2^e)$$

and

$$D_2(p_1, p_2, d_1^e, d_2^e) = \frac{1}{2} + \frac{1}{2}(p_1 - p_2) + \frac{\beta}{2}(1 - 2\gamma)(d_2^e - d_1^e)$$

for editor 2. More generally, defining k by $k = \frac{\beta}{3}(1 - 2\gamma)$, the demand function of editor $i, i = 1, 2$, in the press industry writes as

$$D_i(p_1, p_2, d_1^e, d_2^e) = 0$$

when $p_i \geq 1 + p_j + 3k(d_i^e - d_j^e)$;

$$D_i(p_1, p_2, d_1^e, d_2^e) = \frac{1}{2} + \frac{1}{2}(p_i - p_j) + \frac{3k}{2}(d_i^e - d_j^e) \tag{1}$$

when $p_j - 1 + 3k(d_i^e - d_j^e) \geq p_i \geq 1 + p_j + 3k(d_i^e - d_j^e)$; and

$$D_i(p_1, p_2, d_1^e, d_2^e) = 1$$

when $1 + p_j + 3k(d_i^e - d_j^e) \geq p_i \geq 0$.

The expected difference $(d_i^e - d_j^e)$ between the advertising volumes accepted by the editors, whether positive or negative, plays a crucial role in the determination of demands in the newspapers' market : at equal prices, the editor with the larger advertising volume benefits from a larger demand in this market if and only if the majority of the readers is ad-lover, that is, $\gamma < \frac{1}{2}$. This simply expresses the fact that, if the majority of the readers is ad-lover, they perceive, at equal prices, the newspaper with the larger advertising surface as being more attractive than the other.

The advertising market The population of advertisers is represented by the unit interval $[0;1]$; they are ranked in this interval by order of increasing willingness to pay for an ad. Each advertiser θ; $\theta \in [0;1]$; buys an ad in one of the two newspapers, at the exclusion of the other (ads are indivisible). We assume that the utility of advertiser θ depends on the readership of each newspaper: the utility of inserting an ad in newspaper i increases proportionately to its readership. More precisely, we suppose that the utility of buying an ad in newspaper i at a unit rate s_i is given by

$$U_i(\theta) = D_i^e \theta - s_i;$$

where D_i^e corresponds to the readership of editor i as expected by the advertisers. We require that $D_1^e + D_2^e = 1$:

In the advertising market strategies are the advertising rates s_1 and s_2: Then the advertiser $\theta(s_1;s_2)$ who is indifferent between buying an ad in newspaper 1 or newspaper 2 at rates s_1 and s_2 is identified by the condition

$$D_1^e \theta - s_1 = D_2^e \theta - s_2$$

or

$$\theta(s_1;s_2;D_1^e;D_2^e) = \frac{s_1 - s_2}{D_1^e - D_2^e}:$$

Similarly, the advertiser $\theta(s_i)$ who is indifferent between buying an ad in newspaper i or not buying at all is identified by the condition

$$\theta(s_i;D_i^e) = \frac{s_i}{D_i^e}:$$

Accordingly, when $D_1^e > D_2^e$; the advertising demand functions in the second period are given by

$$d_1(s_1;s_2;D_1^e;D_2^e) = 1 - \frac{s_1 - s_2}{D_1^e - D_2^e} \tag{2}$$

for editor 1, and by

$$d_2(s_1;s_2;D_1^e;D_2^e) = \frac{s_1 - s_2}{D_1^e - D_2^e} - \frac{s_2}{D_2^e} \tag{3}$$

for editor 2. When $D_2^e > D_1^e$; these demand functions have to be reversed since editor 2 is now market leader in the advertising market, namely

$$d_1(s_1;s_2;D_1^e;D_2^e) = \frac{s_2 - s_1}{D_2^e - D_1^e} - \frac{s_1}{D_1^e}$$

for editor 1 and

$$d_2(s_1;s_2;D_1^e;D_2^e) = 1 - \frac{s_2 - s_1}{D_2^e - D_1^e}$$

for editor 2.[7] When $D_1^e = D_2^e = D^e$, the newspapers offer to the advertisers a homogeneous good. The editor i who sets the lower price captures all the market, i.e.

$$d_i(s_1, s_2, D^e) = 1 - \frac{s_i}{D^e}, \text{ if } s_i < s_j$$

while

$$d_1(s_1, s_2, D^e) + d_2(s_1, s_2, D^e) = 1 - \frac{s}{D^e}, \; d_i \geq 0, \; i = 1, 2, \text{ if } s_1 = s_2 = s.$$

Combining editor i's editorial and advertising revenue, his toral revenue R_i writes as

$$R_i(p_1, p_2, s_1, s_2, D_1^e, D_2^e, d_1^e, d_2^e) = p_i D_i(p_1, p_2, d_1^e, d_2^e) + s_i d_2(s_1, s_2, D_1^e, D_2^e), \quad i = 1, 2. \tag{4}$$

The definition of equilibrium Our equilibrium concept is that of fulfilled expectations Bertrand equilibrium, where each firm simultaneously chooses both its price and rate given consumers' expectations in both markets. The timing of the game is as follows. First, readers form expectations about the advertising volumes in the competing newspapers and advertisers form expectations about the number of readers of each printed media. Second, the firms play simultaneously a price game on the two markets. A strategy for editor i is a pair (p_i, s_i). This determines the prices of the newspapers and the advertising rates. Then readers and advertisers make their purchase decisions.

Definition 1 A fulfilled expectations Bertrand equilibrium is a couple of strategies

$((p_1(d_1^e, d_2^e), s_1(D_1^e, D_2^e)), (p_2(d_1^e, d_2^e), s_2(D_1^e, D_2^e)))$ and a vector of expected demands $(D_1^e, D_2^e, d_1^e, d_2^e)$ such that :

(i) each editor i chooses its newspaper price p_i and advertising rate s_i as a best reply to the newspaper price and the advertising rate chosen by its competitor, given readers' and advertisers' expectations $(D_1^e, D_2^e, d_1^e, d_2^e)$;

(ii) expectations are fulfilled, i.e.

$$d_i(s_1^*(D_1^e, D_2^e), s_2^*(D_1^e, D_2^e), D_1^e, D_2^e) = d_i^e, \; i = 1, 2. \tag{5}$$

$$D_i(p_1(d_1^e, d_2^e), p_2(d_1^e, d_2^e), d_1^e, d_2^e) = D_i^e. \tag{6}$$

[7] These demand functions are those of a vertical differentiation model in which the editor enjoying the larger demand in the press industry sells the high quality product to the advertisers ; see Mussa and Rosen (1978).

Part (i) of the above definition is the standard Bertrand assumption: it states that given any set of expectations, there is a Bertrand equilibrium on each of the two markets. At these Bertrand equilibria, expectations are generally not fulfilled: the actual advertising volumes and readerships differ from the expected ones. Part (ii) of the definition further requires from an equilibrium that expectations be fulfilled.

3 The price game

We first identify the Bertrand equilibria of the game for any given set of expectations $(D_1^e; D_2^e; d_1^e; d_2^e)$: we determine the pairs of prices $[p_1^*(d_1^e; d_2^e); p_2^*(d_1^e; d_2^e)]$ and of advertising rates $[s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)]$ which fulfill condition (i) required by the definition of an equilibrium. Substituting for the prices and advertising rates in the demand functions their Bertrand equilibrium values. Then we derive the actual demands on the two markets as functions of the expected demands, i.e. $d_i(s_1(D_1^e; D_2^e); s_2(D_1^e; D_2^e); D_1^e; D_2^e)$ and $D_i(p_1(d_1^e; d_2^e); p_2(d_1^e; d_2^e); d_1^e; d_2^e);\ i = 1; 2$:

Lemmas 1 and 2 characterize the Bertrand equilibria in the printed media and the advertising markets for a given set of consumers' expectations. Corollaries 1 and 2 in the Appendix state the resulting demands in each market.

Lemma 1 Bertrand equilibrium in the printed media market.

The pair of prices fulfilling condition (i) required by the definition of an equilibrium are:

(a) If

$$-1 < k(d_1^e - d_2^e) < 1; \tag{7}$$

$$\begin{aligned} p_1^*(d_1^e; d_2^e) &= 1 + k(d_1^e - d_2^e) \\ p_2^*(d_1^e; d_2^e) &= 1 - k(d_1^e - d_2^e) \end{aligned} \tag{8}$$

(b) If

$$k(d_1^e - d_2^e) \geq 1; \tag{9}$$

$$\begin{aligned} p_1^*(d_1^e; d_2^e) &= -1 + 3k(d_1^e - d_2^e) \\ p_2^*(d_1^e; d_2^e) &= 0 \end{aligned} \tag{10}$$

(c) If

$$k(d_1^e - d_2^e) \leq -1; \tag{11}$$

$$\begin{aligned} p_1^*(d_1^e; d_2^e) &= 0 \\ p_2^*(d_1^e; d_2^e) &= -1 - 3k(d_1^e - d_2^e) \end{aligned} \tag{12}$$

Proof: see Appendix

Notice that the Bertrand equilibrium prices are continuous, though not continuously differentiable, functions of the expected difference $d_1^e - d_2^e$ between the advertising volumes sold by the editors. Furthermore, for any given set of expectations, these prices are unique.

Lemma 2 Bertrand equilibrium in the advertising market.

The pair of prices fulfilling condition (i) required by the definition of an equilibrium are:

(a) If $D_1^e > D_2^e > 0$

$$\begin{aligned} s_1^*(D_1^e, D_2^e) &= \frac{2D_1^e(D_1^e - D_2^e)}{4D_1^e - D_2^e} \\ s_2^*(D_1^e, D_2^e) &= \frac{D_2^e(D_1^e - D_2^e)}{4D_1^e - D_2^e}, \end{aligned} \tag{13}$$

(b) If $D_2^e > D_1^e > 0$

$$\begin{aligned} s_1^*(D_1^e, D_2^e) &= \frac{D_1^e(D_2^e - D_1^e)}{4D_2^e - D_1^e} \\ s_2^*(D_1^e, D_2^e) &= \frac{2D_2^e(D_2^e - D_1^e)}{4D_2^e - D_1^e} \end{aligned} \tag{14}$$

(c)If $D_1^e = 1$ and $D_2^e = 0$

$$\begin{aligned} s_1^*(D_1^e, D_2^e) &= \frac{1}{2} \\ s_2^*(D_1^e, D_2^e) &= 0 \end{aligned} \tag{15}$$

(d) If $D_1^e = 0$ and $D_2^e = 1$

$$\begin{aligned} s_1^*(D_1^e, D_2^e) &= 0 \\ s_2^*(D_1^e, D_2^e) &= \frac{1}{2} \end{aligned} \tag{16}$$

(e) If $D_2^e = D_1^e = \frac{1}{2}$

$$s_i^*(D_1^e, D_2^e) = 0; \; i = 1, 2 \tag{17}$$

Proof: see Appendix

Notice that the Bertrand equilibrium advertising rates are unique for any set of expectations and that they are continuous, though not continuously differentiable, functions of D_1^e and D_2^e:

4 The Ful…lled Expectations Equilibria

Now we characterize the ful…lled expectations equilibria satisfying condition (ii) of our equilibrium de…nition. This amounts to determine the …xed points of the correspondence de…ned by equations (19) to (21) and (13) to (16) from the set of expected demands into itself. It …rst appears that symmetric expectations ($d_1^e = d_2^e; D_1^e = D_2^e$) about advertising market shares makes the game itself totally symmetric : then, it is not surprising, and true for all values of °, that the corresponding equilibrium is itself symmetric. Moreover this is the only equilibrium in the ad-repulsion case.

Proposition 1 (symmetric equilibrium) Whatever the value of ° in $[0;1]$; there exists a symmetric ful…lled expectations equilibrium, i.e. an equilibrium corresponding to symmetric expectations, with prices and market shares equal in both markets. Whenever there is a majority of ad-avoiders ($° > \frac{1}{2}$) this equilibrium is unique.

Proof: (i) existence: from Lemma 1 when $d_1^e = d_2^e$ it turns out that $D_1 = D_2 = \frac{1}{2}$. From Lemma 2 when $D_1^e = D_2^e = \frac{1}{2}$ we obtain $d_1 + d_2 = 1$: It follows that there always exists a ful…lled expectations equilibrium such that $D_1^e = D_2^e = \frac{1}{2} = d_1^e = d_2^e$: At this equilibrium the advertising rates are zero and the newspapers prices are both equal to 1.

(ii) uniqueness: if $° > \frac{1}{2}$ it must be that $k < 0$: Suppose that there exists an asymmetric ful…lled expectations equilibrium such that $d_1^e > d_2^e$. From Corollary 1 since $k < 0$; we obtain $D_1 < D_2$, so that the rationality of expectations imposes that $D_1^e < D_2^e$:Now from Corollary 2 $d_1 < d_2$; so that the rationality of expectations imposes that . $d_1^e < d_2^e$; hence a contradiction. Of course a similar argument rules out the case $d_1^e < d_2^e$: Accordingly the equality $d_1^e = d_2^e$ is requested at equilibrium. Now from Corollary 1 one obtains as well $D_1^e = D_2^e$:¥

In the following we consider the possibility of ful…lled expectations equilibria with asymmetric expectations ($d_1^e \neq d_2^e$ and/or $D_1^e \neq D_2^e$). We have just seen that no such asymmetric equilibria could exist when there is a majority of ad-avoiders: in this case only the symmetric equilibrium survives. However, when there is a majority of ad-lovers, the symmetric equilibrium is never unique. Beyond the latter there are also asymmetric equilibria, of particular relevance in the media industries.

Proposition 2 (asymmetric equilibria) With a majority of ad-lovers ($° < \frac{1}{2}$), there exist, on top of the symmetric equilibrium, asymmetric ful…lled expectations equilibria:

(i) no-eviction asymmetric equilibria: When $0 < k < 4$; there are two mirror asymmetric ful…lled expectations equilibria providing strictly positive market shares in the two markets to both editors (see equations (33) and (36) in Appendix). The editor who is expected to sell more advertising has higher prices and larger market shares in both markets.

(ii) eviction asymmetric equilibria: When $2 \leq k$; the two mirror asymmetric equilibria are such that one of the editors evicts his rival out of both markets. The editor who evicts the other is the one who is expected to sell more advertising.

Proof: (i) Without loss of generality let us show that there exists an equilibrium such that $D_1^e > D_2^e > 0$ when $0 < k < 4$: From Corollary 2 since $D_1^e > D_2^e > 0$ we must observe at such an equilibrium that $d_1 = \frac{2D_1}{4D_1 - D_2} > d_2 = \frac{D_1}{4D_1 - D_2}$: Now from Corollary 1, since $D_1^e > D_2^e > 0$, it follows from the fulfilled expectations assumption that we must be in the case, corresponding to condition (7), where $D_1 = \frac{1}{2}(1 + k(d_1 - d_2))$ and $D_2 = \frac{1}{2}(1 - k(d_1 - d_2))$: Substituting the above values for d_1 and d_2 in these expressions of D_1 and D_2; we obtain the system

$$
\begin{aligned}
D_1 &= \frac{1}{2}\left(1 + \frac{kD_1}{4D_1 - D_2}\right) \qquad (18)\\
D_2 &= \frac{1}{2}\left(1 - \frac{kD_1}{4D_1 - D_2}\right):
\end{aligned}
$$

The solution of (18) is given in expression (33) in the Appendix.[8] It is easy to show that these values are strictly positive and such that $D_1^* > D_2^*$ if and only if $0 < k < 4$, and that consequently condition (7) is satisfied iff $k \leq 4$: A similar argument applies to show the existence of a mirror equilibrium whith $D_1^e < D_2^e < 0$, corresponding to the same interval of values of k:

(ii) If there exists an equilibrium where $D_1 = 1$ and $D_2 = 0$ we also must observe from Corollary 2 that $d_1 = 1$ and $d_2 = 0$: From Lemma 1 and Corollary 1 this occurs iff and only if $k(d_1^e - d_2^e) \geq 1$, i.e. $k \geq 2$: By the same argument there exists an equilibrium where $D_1 = 0$ and $D_2 = 1$ iff $k \geq 2$: ■

Notice that in the eviction case the newspapers' prices are given by

$$
\begin{aligned}
p_1^* &= -1 + \frac{3k}{2}\\
p_2^* &= 0
\end{aligned}
$$

if $D_1 = 1$ and $D_2 = 0$ and

$$
\begin{aligned}
p_1^* &= -1 + \frac{3k}{2}\\
p_2^* &= 0
\end{aligned}
$$

[8] The Appendix also includes all other equilibrium values.

if $D_1 = 0$ and $D_2 = 1$:

Given that the number of readers of each newspaper cannot be negative and that the total number of readers is fixed (and equal to 1) the only possible equilibria in the ad-attraction case are: (i) the symmetric one described in Proposition 1 which exists for all possible values of k, (ii) the two asymmetric equilibria without eviction which exist for all $k \in (0;4)$ and (iii) the two asymmetric equilibria with eviction which exist for all $k \geq 2$.[9]

In the case of ad-attraction, the asymmetric equilibria described in Proposition 2 correspond exactly to the limit point of the market dynamics imagined by Furhoff (1973), and observed by Gustafsson (1978) and Engwall (1981) in the Swedish press industry. These authors explain the growth of concentration observed within the newspaper industry as a result of a dynamic interaction between the advertising and newspapers' markets in the so-called "circulation spiral".[10] In case of significant ad-attraction (large value of the ad-attraction parameter β and/or small value of γ); the editor who is expected to sell a larger number of ads is expected to offer a more attractive newspaper than his rival's. The more ads the former inserts, the more he reinforces its attractiveness, setting in motion the circulation spiral which leads to the eviction of the rival from both the readers and advertising markets. The two other asymmetric equilibria, even if they also exist for large values of the ad-attraction parameter, seem to correspond better to situations where competition operates in a context of weaker ad-attraction. Then concentration in the press industry should probably not be expected as a consequence of advertising since, in spite of the asymmetry of beliefs, both editors keep at these equilibria a strictly positive market share in the press industry. Nonetheless, the initial asymmetry of beliefs about advertising market' shares makes the editor with the larger expected share the leader in both industries since he sells more in both, and at higher prices. Finally, symmetric expectations about advertising market shares makes the game itself totally symmetric : then, it is not surprising, and true for all values of γ, that the corresponding equilibrium is itself symmetric (proposition 1). In particular, in this case, both advertising rates are driven to zero through Bertrand competition. With positive marginal cost, advertising rates would be set to equal marginal cost. In any case, editors' profits are equal to zero at equilibrium in the advertising market when beliefs are symmetric. Also the smallest deviation from perfectly symmetric expectations renders extremely weak the probability

[9] In the case of ad-attraction one can safely conjecture that the only possibly stable equilibria are asymmetric (for a similar statement in the case of intramarket positive externalities see Katz and Shapiro (1985), page 432): the asymmetric equilibria without eviction when $k<4$ and the two asymmetric equilibria with eviction when $k>4$. Of course this means that we conjecture that the equilibria with eviction are not stable when $k \in [2;4)$.

[10] According to this theory, "the larger of two competing newspapers is favoured by a process of mutual reinforcement between circulation and advertising, as a larger circulation attracts advertisements, which in turn attracts more advertising and again more readers. In contrast, the smaller of two competing newspapers is caught in a vicious circle; its circulation has less appeal for the advertisers, and it loses readers if the newspaper does not contain attractive advertising. A decreasing circulation again aggravates the problems of selling advertising space, so that finally the smaller newspaper will have to close down" (Gustafsson (1978), p. 1).

of observing the symmetric outcome at equilibrium. Finally, to conclude our comments about the above propositions, it is also important to stress the fact that it is only in the case of ad-attraction that the asymmetric equilibria exist : only the symmetric one still survives under ad-repulsion.

5 Ad-repulsion and exit from the advertising market

In the case of significant ad-repulsion an editor might also contemplate a new strategic option: would it not be more advantageous to withdraw from the advertising market altogether, rather than compete with a rival? The introduction of ads in the newspaper drastically reduces the market share in the press industry and the resulting loss can more than offset the gains obtained from advertising revenues. Since no equilibrium exists with ad-repulsion and asymmetric beliefs, we study this problem in the case of symmetric beliefs, namely when $d_1^e = d_2^e$. In this case, there exists a unique equilibrium in which no advertising revenues accrue to the editors since advertising rates are equal to zero. We can accordingly evaluate precisely what would be the advantage an editor could obtain from deviating from this equilibrium and exerting his outside option, rather than competing with his rival in the advertising market.

Thus, suppose that ad-repulsion is observed ($\gamma > \frac{1}{2}$), which in turn implies $k = \frac{\beta}{3}(1 - 2\gamma) < 0$. Suppose also that one editor, say editor 1, credibly commits himself to withdraw from the advertising market. Then editor 2 is a monopolist in this market and sets a price $s_2 = \frac{D_2}{2}$ generating a market demand d_2 equal to $\frac{1}{2}$. Substituting this value in the demand and equilibrium price functions of the readers' market, we obtain

$$\begin{aligned} D_1^* &= \frac{1}{2}(1 - \frac{1}{2}k) \\ D_2^* &= \frac{1}{2}(1 + \frac{1}{2}k) \end{aligned}$$

and

$$\begin{aligned} p_1^* &= (1 - \frac{1}{2}k) \\ p_2^* &= (1 + \frac{1}{2}k) \end{aligned}$$

when $-2 < k$. Accordingly, in this case, editors' revenues write as

$$\begin{aligned} R_1(p_1^*, p_2^*, s_1^*, s_2^*) &= \frac{1}{2}(1 - \frac{1}{2}k)^2 \\ R_2(p_1^*, p_2^*, s_1^*, s_2^*) &= \frac{1}{8}k^2 + \frac{5}{8}k + \frac{3}{4}. \end{aligned}$$

In the opposite case ($k \leq -2 < 0$), editor 1 evicts his rival at equilibrium ($D_1^* = 1; D_2^* = 0$), equilibrium prices are $p_1^* = 1; p_2^* = 0$; and editors' revenues write as

$$\begin{aligned} R_1(p_1^*; p_2^*; s_1^*; s_2^*) &= 1 \\ R_2(p_1^*; p_2^*; s_1^*; s_2^*) &= 0. \end{aligned}$$

The revenues we have just identified should now be compared with those obtained by the editors when either both simultaneously decide to advertise, or to exert their outside option. In the first alternative, we know that, at equilibrium, we have

$$p_1^* = p_2^* = 1$$

and

$$s_1^* = s_2^* = 0$$

leading to equilibrium revenues

$$R_i(p_1^*; p_2^*; s_1^*; s_2^*) = \frac{1}{2}.$$

In the second alternative, in which neither editor accepts ads in his newspaper, the advertising market disappears and only the readers' market survives. It is immediate to check that, in this market, the sole price equilibrium is then given by

$$p_1^* = p_2^* = 1$$

with corresponding market shares $D_i^* = \frac{1}{2}$ and revenues $R_i(p_1^*; p_2^*) = \frac{1}{2}; i = 1; 2.$

Accordingly, we obtain the following bi-matrix game, with two strategies for each editor: "Advertise (A) - Not advertise (NA)" and corresponding payoffs

	A	NA
A	$\frac{1}{2}; \frac{1}{2}$	$\frac{1}{8}k^2 + \frac{5}{8}k + \frac{3}{4}; \frac{1}{2}(1 - \frac{1}{2}k)^2$
NA	$\frac{1}{2}(1 - \frac{1}{2}k)^2; \frac{1}{8}k^2 + \frac{5}{8}k + \frac{3}{4}$	$\frac{1}{2}; \frac{1}{2}$

when $k > -2$; and

	A	NA
A	$\frac{1}{2}; \frac{1}{2}$	$0; 1$
NA	$1; 0$	$\frac{1}{2}; \frac{1}{2}$

when $k \leq -2$. Notice that, since $k < 0$; we have $\frac{1}{2}(1 - \frac{1}{2}k)^2 > \frac{1}{2}$; so that the pair of strategies $(A; A)$ can, in neither case, be a Nash equilibrium of the corresponding bi-matrix game. Furthermore, it is easy to check that the profit of the editor that stays in the market while the other exits, that is,

$$\frac{1}{8}k^2 + \frac{5}{8}k + \frac{3}{4} \geq \frac{1}{2} \text{ if, and only if, } k \in \left[\underline{k}; \bar{k}\right]; \text{ where } \underline{k} = -\frac{5}{2} - \frac{\sqrt{17}}{2} \text{ and } \bar{k} = -\frac{5}{2} + \frac{\sqrt{17}}{2}.$$

Notice that the critical value -2 belongs to this interval. Thus we conclude that

Proposition 3 When there is a majority of ad-avoiders ($° > \frac{1}{2}$) and symmetric expectations ($d_1^e = d_2^e$), at least one of the editors exits from the advertising market:

(i) concentration in the advertising market: When $\overset{1}{k} \cdot k = \frac{¯}{3}(1$ ¡ $2°) < 0$; the above bi-matrix game has two mirror Nash equilibria in which one of the two editors advertises while the other exerts his outside option ;

(ii) closing of the advertising market: When $k = \frac{¯}{3}(1$ ¡ $2°) \cdot \overset{1}{k} < 0$; the unique Nash equilibrium consists of the pair of strategies at which both editors exert their outside option.

Proposition 3 states that in the case of ad-repulsion and symmetric expectations, there is a natural tendency to monopoly in the advertising market. Either a single editor stays as a monopolist in the advertising market, while sharing with his rival the market for newspapers; or both editors exert their outside option, closing the advertising market. In the latter case, they equally share the newsprint industry.

6 Conclusion

In the present paper, we have analyzed the competition between two …rms operating in two markets linked by intermarket network externalities, a situation in which the utility of a good produced in a given market varies with the size of the demand for a good produced in the other, and conversely. Our main result is that this competition may result into (i) the eviction of one of the two …rms from both markets when there are two-sided positive intermarket externalities, or (ii) the voluntary exit of one or both …rms from the market that generates negative externalities. This result hinges on the set of expectations about demands in both markets, which we assume to be given. Thus, the structure of the equilibria in our model con…rms the crutial importance of consumers' expectations when intermarket network externalities are present, as was already noticed by Katz and Shapiro (1985) in the case of intramarket network externalities. We have only asked from expectations to be ful…lled in equilibrium but the process through which expectations are formed remains to be explored. In particular, we conjecture that if we had assumed that consumers form their expectations after the …rms choose their prices in the two markets this would have only reinforced the tendencies we describe. Accounting for the e¤ects of prices changes on expectations is indeed likely to exacerbate competition between the …rms, at least when there are positive externalities.

We have argued that these results may contribute to explain by a game-theoretic approach the tendency to concentration observed in the media industries, particularly in the printed media. Public information about politics and opinions plays an essential role in the day-to-day operation of a democracy: when TV channels belong to a single owner or there is a fall in the number of newspapers, the democratic debate might be endangered.[11] Our equilibrium

[11] The question of concentration in the media industries has been studied from di¤erent

analysis when applied to the printed media industry confirms the heuristic prediction of Furhoff (1973): eviction of one of the competitors may be expected at equilibrium, but only when ad-attraction is observed for a majority of the readers' population. However, under ad-repulsion, the "circulation spiral" is not set in motion, confirming the essential role of the advertising market to explain concentration in the press industry. Our approach is static but can be thought as describing the limit point of a tatonnement process through which expectations are adjusted.

Under ad-repulsion, we showed that editors may prefer to withdraw from the advertising market. In fact there are alternative "outside options" to this one: in particular, an editor might differentiate more adequately his newspaper's content by specializing on a particular "niche" of readers. He can thereby resist to competitive rivalry and still remain attractive for the advertisers willing to advertise precisely to this specific "niche". This is the purpose of targeting, an advertising method aiming precisely at finding the advertising support which is the best adapted to the sale of a particular product to a particular class of consumers. The threat of market eviction, which mainly affects editors with small and specialized readerships, could also be weakened by cooperative agreements signed among them. According to these agreements, the editors who are in the syndicate decide to collectively bargain the advertising rates (combination rates) at which ads will be simultaneously inserted in all the newspapers. Advertisers benefit from access to specialized readership and editors offer a sizeable readership to the advertisers. Thus, eviction can be avoided thanks to these cooperative agreements that mimic concentration in the advertising market only.

7 Appendix

Corollary 1 (i) If (7) holds

$$
\begin{aligned}
D_1(d_1^e, d_2^a) &= \frac{1}{2}(1 + k(d_1^e - d_2^a)) \qquad (19)\\
D_2(d_1^e, d_2^a) &= \frac{1}{2}(1 - k(d_1^e - d_2^a)).
\end{aligned}
$$

(ii)If (9) holds

perspectives. In particular, for empirical investigations concerning concentration in printed media see Rosse (1967, 1978), Compaine (1979), Thompson (1984, 1989), Picard (1988), Dertouzos and Trautman (1990), Reimer (1992), Kaitatzi-Whitlock (1996), Le Floch (1997), among others. Pettersen-Strandenes (1994) evokes network effects as a possible explanation to underpricing in the daily newspaper market in Oslo. Similarly, a recent contribution by Genesove (2003) provides a new explanation for daily press concentration also relying on network effects.

$$
\begin{aligned}
D_1(d_1^e; d_2^a) &= 1 \\
D_2(d_1^e; d_2^a) &= 0
\end{aligned}
\tag{20}
$$

(iii) If (11) holds

$$
\begin{aligned}
D_1(d_1^e; d_2^a) &= 0 \\
D_2(d_1^e; d_2^a) &= 1
\end{aligned}
\tag{21}
$$

- Proof of lemma 1 and corollary 1:

we first list the following properties of the payoff functions defined by (4) :
(1) the derivative $\frac{\partial R_i}{\partial p_i}$ is strictly positive for all values of p_i such that $D_i(p_1; p_2; d_1; d_2) = 1; i = 1; 2$;
(2) the derivative $\frac{\partial R_i}{\partial p_i}$ is equal to 0 when $D_i(p_1; p_2; d_1; d_2) = 0; i = 1; 2$;
(3) for all values of p_i such that the right-hand side of (4) belongs to $[0; 1]$:

$$\frac{\partial R_i}{\partial p_i} = \frac{1}{2}(1 + p_j - 2p_i) + \frac{3k}{2}(d_i^e - d_j^e): \tag{22}$$

(i) For all values of $(p_1; p_2)$ such that the right-hand side of (4) belongs to $]0; 1[$; we obtain $\frac{\partial R_i}{\partial p_i} = \frac{1}{2}(1 + p_j - 2p_i) + \frac{3k}{2}(d_i^e - d_j^e)$: Consequently, any pair of prices fulfilling condition (i) must solve the first-order conditions

$$\frac{\partial R_i}{\partial p_i} = \frac{1}{2}(1 + p_j - 2p_i) + \frac{3k}{2}(d_i^e - d_j^e) = 0;$$

$i = 1; 2$: It follows that such a pair of prices must satisfy

$$
\begin{aligned}
p_1^*(d_1^e; d_2^e) &= 1 + k(d_1^e - d_2^e) \\
p_2^*(d_1^e; d_2^e) &= 1 - k(d_1^e - d_2^e)
\end{aligned}
$$

with corresponding demands

$$
\begin{aligned}
D_1(d_1^e; d_2^e) &= \frac{1}{2}(1 + k(d_1^e - d_2^e)) \\
D_2(d_1^e; d_2^e) &= \frac{1}{2}(1 - k(d_1^e - d_2^e)):
\end{aligned}
\tag{23}
$$

The two inequalities $D_1(d_1^e; d_2^e) = \frac{1}{2}(1 + k(d_1^e - d_2^e)) > 0$ and $D_2(d_1^e; d_2^e) = \frac{1}{2}(1 - k(d_1^e - d_2^e)) > 0$ hold if, and only if

$$-1 < k(d_1^e - d_2^e) < 1:$$

Furthermore, we notice that, when it is assumed that $k > 0$; we must have

$$D_1(d_1^e; d_2^e) > D_2(d_1^e; d_2^e) \iff d_1^e - d_2^e > 0$$

which also implies $p_1^*(d_1^e; d_2^e) > p_2^*(d_1^e; d_2^e) > 0$: On the contrary, under the same assumption, we have

$$D_2(d_1^e; d_2^e) > D_1(d_1^e; d_2^e) \iff d_2^e - d_1^e > 0$$

which also implies $p_2^*(d_1^e; d_2^e) > p_1^*(d_1^e; d_2^e) > 0$: Finally, we observe that, when $d_1^e - d_2^e = 0$; we have from (8) that $p_1^*(d_1^e; d_2^e) = p_2^*(d_1^e; d_2^e)$; with

$$D_1(d_1^e; d_2^e) = D_2(d_1^e; d_2^e) = \frac{1}{2}:$$

-

(ii) Assume that there exists a pair of prices $[p_1^*(d_1^e; d_2^e); p_2^*(d_1^e; d_2^e)]$ fulfilling condition (i) required by the definition of an equilibrium, such that $D_1(d_1^e; d_2^e) = 1$ and $D_2(d_1^e; d_2^e) = 0$: This pair of prices must be robust against any unilateral deviation of editor $i; i = 1; 2$; from the corresponding price $p_i^*(d_1^e; d_2^e)$: Notice that, since $D_1(d_1^e; d_2^e) = 1$; it follows from the right-hand side of (4) that the equality

$$p_1^*(d_1^e; d_2^e) = p_2^*(d_1^e; d_2^e) - 1 + 3k(d_1^e - d_2^e) \quad (24)$$

must necessarily hold. On the other hand, editor 1 should not benefit from increasing his price beyond this value, a condition which holds true if, and only if

$$p_2^*(d_1^e; d_2^e) \geq 3(1 - k(d_1^e - d_2^e)): \quad (25)$$

Finally, editor 2 is indifferent between all prices p_2 satisfying the inequality

$$p_2 \geq p_1^*(d_1^e; d_2^e) + 1 - 3k(d_1^e - d_2^e)$$

(remember that, at such prices, $D_2(d_1^e; d_2^e) = 0$). But editor 2 should also be prevented from using price strategies strictly smaller than this value in view of obtaining a strictly positive market share. This last condition is equivalent to

$$p_1^*(d_1^e; d_2^e) \leq -1 + 3k(d_1^e - d_2^e);$$

which, in order to be consistent with (24), requires that $p_2^*(d_1^e; d_2^e) = 0$: Thus, we conclude that the pair of prices

$$\begin{aligned} p_1^*(d_1^e; d_2^e) &= -1 + 3k(d_1^e - d_2^e) \\ p_2^*(d_1^e; d_2^e) &= 0; \end{aligned} \quad (26)$$

leading to demands $D_1(d_1^e; d_2^e) = 1$ and $D_2(d_1^e; d_2^e) = 0$ in the readership's market, also satisfies the condition (i) required by the definition of an equilibrium whenever condition (25) holds. Notice that, due to the fact that $p_2^*(d_1^e; d_2^e) = 0$; condition (25) is equivalent to

$$k(d_1^e - d_2^e) \geq 1:$$

With $k > 0$; as assumed, this condition can hold only if $d_1^e - d_2^e > 0$; it also implies that $p_1^*(d_1^e; d_2^e) \geq 0$. ■

Proof of Lemma 2:

(i) When $D_1^e > D_2^e > 0$ the demands for advertising are given by equations (2) and (3). Maximizing the editors payoffs R_1 and R_2 with respect to s_1 and s_2; respectively, yields the first-order conditions

$$\begin{aligned} \frac{\partial R_1}{\partial s_1} &= 1 - \frac{2s_1 - s_2}{D_1^e - D_2^e} = 0 \\ \frac{\partial R_2}{\partial s_2} &= \frac{s_1 - 2s_2}{D_1^e - D_2^e} - \frac{2s_2}{D_2^e} = 0. \end{aligned}$$

Solving for s_1 and s_2 yields (13). A similar argument yields (14) in the case where $D_2^e > D_1^e > 0$.

(ii) When $D_1^e = 1$ and $D_2^e = 0$ editor 2 is expected by the advertisers to have a zero market share in the readers' market so that advertisers expect to get no utility from buying ads in his newspaper so that editor 1 is a monopolist in the advertising market, i.e.

$$\begin{aligned} d_1(s_1; s_2) &= 1 - \frac{s_1}{D_1} \\ d_2(s_1; s_2) &= 0 \end{aligned}$$

With $D_1 = 1$; the advertising revenue of editor 1 is equal to $s_1(1 - s_1)$. Maximizing this payoff with respect to s_1 yields (15). When $D_1^e = 0$ and $D_2^e = 1$ a similar argument yields (16). ■

Corollary 2 (i) If $D_1^e > D_2^e > 0$

$$\begin{aligned} d_1(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= \frac{2D_1^e}{4D_1^e - D_2^e} \\ d_2(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= \frac{D_1^e}{4D_1^e - D_2^e}; \end{aligned} \tag{27}$$

which entails

$$d_1(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) - d_2(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) = \frac{D_1^e}{4D_1^e - D_2^e}. \tag{28}$$

(ii) If $D_2^e > D_1^e > 0$

$$\begin{aligned} d_1(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= \frac{D_2^e}{4D_2^e - D_1^e} \\ d_2(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= \frac{2D_2^e}{4D_2^e - D_2^e} \end{aligned} \tag{29}$$

(iii) If $D_1^e = 1$ and $D_2^e = 0$

$$\begin{aligned} d_1(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= \frac{1}{2} \\ d_2(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= 0 \end{aligned} \tag{30}$$

(iv) If $D_1^e = 0$ and $D_2^e = 1$

$$\begin{aligned} d_1(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= 0 \\ d_2(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) &= \frac{1}{2} \end{aligned} \tag{31}$$

(v) If $D_2^e = D_1^e = \frac{1}{2}$

$$\sum_{i=1}^{2} d_i(s_1^*(D_1^e; D_2^e); s_2^*(D_1^e; D_2^e)) = 1 \tag{32}$$

Proof: It is enough to substitute for the tariffs their Bertrand equilibrium values in the demands for advertising functions.

- Equilibrium values in the case $D_1 > D_2 > 0$:

To spell out the explicit values of newspapers' prices and advertising rates at equilibrium, we solve the system (18)[12], i.e.

$$\begin{aligned} D_1^* &= \frac{1}{20}(7 + k + \sqrt{9 + 14k + k^2}) \\ D_2^* &= \frac{1}{20}(13 - k - \sqrt{9 + 14k + k^2}). \end{aligned} \tag{33}$$

Introducing (33) into (28), we get

$$d_1^* - d_2^* = \frac{7 + k + \sqrt{9 + 14k + k^2}}{5(3 + k + \sqrt{9 + 14k + k^2})}; \tag{34}$$

which, in turn, by substitution of (34) into (8), gives the newspapers' prices at equilibrium, namely

$$\begin{aligned} p_1^* &= 1 + k\left(\frac{7 + k + \sqrt{9 + 14k + k^2}}{5(3 + k + \sqrt{9 + 14k + k^2})}\right) \\ p_2^* &= 1 - k\left(\frac{7 + k + \sqrt{9 + 14k + k^2}}{5(3 + k + \sqrt{9 + 14k + k^2})}\right) \end{aligned} \tag{35}$$

[12] There is another solution to this system, namely

$$\begin{aligned} D_1 &= \frac{1}{20}(7 + k - \sqrt{9 + 14k + k^2}) \\ D_1 &= \frac{1}{20}(13 - k + \sqrt{9 + 14k + k^2}). \end{aligned}$$

However, these values do not correspond to an equilibrium since we have here $D_1 < D_2$; contradicting our initial assumption.

Direct substitution of (33) into (13) provides the equilibrium advertising rates

$$
\begin{aligned}
s_1^* &= \frac{(-3+k+\sqrt{9+14k+4k^2})(7+k+\sqrt{9+14k+k^2})}{25(3+k+\sqrt{9+14k+k^2})} \qquad (36)\\
s_2^* &= \frac{(-3+k+\sqrt{9+14k+4k^2})(13-k+\sqrt{9+14k+k^2})}{50(3+k+\sqrt{9+14k+k^2})}.
\end{aligned}
$$

8 Bibliography

References

[1] Armstrong, M. (2002): "Competition in Two-Sided Markets", mimeo, Nuffield College, Oxford.

[2] Anderson, S., and S. Coate (2001): "Market Provision of Public Goods: the case of Broadcasting", mimeo, University of Virginia.

[3] Blair, R., and R. E. Romano (1993): "Pricing Decisions of the Newspaper Monopolist", Southern Economic Journal, 54(1), 721-732.

[4] Brown, T.J., and M.L. Rothshild (1993): "Reassessing the Impact of Television Advertising Clutter", Journal of Consumer Research, 20, 138-146.

[5] Bucklin, R.E., R.E. Caves and A.W. Lo (1989): "Games of Survival in the US Newspaper Industry", Applied Economics, 21(5), 631-649.

[6] Compaine, B. (1982): Who owns the media? Concentration of ownership in the mass communications industry, ed., Knowledge Industry Publications, White Plains, NY.

[7] Danaher, P.J. (1995): "What Happens to Television Ratings during Commercial Breaks", Journal of Advertising Research, 37, 37-47.

[8] Dertouzos, J.N., and W.B. Trautman (1990): "Economic Effects of Media Concentration: Estimates from a Model of the Newspaper Firm", Journal of Industrial Economics, 39 (1), 1-14.

[9] Engwall, L. (1981): "Newspaper Competition : a Case for Theories of Oligopoly", The Scandinavian Economic History Review, 29(2), 145-154.

[10] Furhoff, L. (1973): Some Reflections on Newspaper Concentration", The Scandinavian Economic History Review, 1, 1-27.

[11] Gabszewicz, J.J., D. Laussel and N. Sonnac (2002): "Network Effects in the Press and Advertising Industries", mimeo, CORE Discussion Paper, 2002/62.

[12] Gal-Or, E., and A. Dukes (2003): "Minimum Di¤erentiation in Commercial Media Markets", Journal of Economics and Management Strategy, 12 (3), 291-325.

[13] Genesove, D. (2003): "Why Are There So Few (and Fewer and fewer) Two-Newspaper Towns ?", mimeo, Hebrew University of Jerusalem, NBER and CEPR.

[14] Grilo, I., O. Shy and J. Thisse (2001): "Price Competition when Consumer Behaviour is characterised by Conformity or Vanity", Journal of Public Economics, 30, 385-408.

[15] Gustafsson, K.E. (1978): "The Circulation Spiral and the Principle of Household Coverage", The Scandinavian Economic History Review, 26(1), 1-14.

[16] Kaitatzi-Whitlock, S. (1996): "Pluralism and Media Concentration in Europe", European Journal of Communication, 11(4), 453-483.

[17] Katz, M.L., and Shapiro C. (1985): "Network Externalities, Competition and Compatibility", American Economic Review, 75(3), 424-440.

[18] Le Floch, P. (1997): Economie de la presse quotidienne régionale : déterminants et conséquences de la concentration, L'Harmattan-SPQR.

[19] Mussa, M., and S. Rosen (1975): "Monopoly and Product quality", Journal of Economic Theory, 18, 301-317.

[20] Musnick, I. (1999): "Le cœur de cible ne porte pas la publicité dans son cœur", CB News, 585, 11-17 octobre, 8-10.

[21] Pettersen Strandenes, S. (1994): "Imperfect Competition in Newspaper Markets", Center for International Economics and Shipping (SIOS), Norwegian School of Economics and Business Administration.

[22] Picard, R. G. et al. (1988): Press Concentration and Monopoly, Norwood, NJ Ablex.

[23] Reimer, E. (1992): "The E¤ects of Monopolization on Newspaper Advertising Rates", American Economist, 36(1), 65-649.

[24] Rochet, J.C., and J. Tirole (2003): "Platform Competition in Two-Sided Markets", The Journal of the European Economic Association, Forthcoming.

[25] Rosse, J.N. (1967): "Daily Newspapers, Monopolistic Competition and Economies of Scale", American Economic Review, LVII (2), 522-534.

[26] Rosse, J.N. (1978): "The Evolution of One Newspaper Cities", Proceedings of the symposium on media concentration, Washington D.C., Federal Trade Commission, 429-471.

[27] Rosse, J.N. (1980): "The Decline of Direct Newspaper Competition", Journal of Competition, 30, 65-71.

[28] Sonnac, N. (2000): "Readers' Attitudes Towards Press Advertising : Are they Ad-lovers or Ad-averse ?", Journal of Media Economics, 13(4), 249-259.

[29] Strömberg, D. (2002): "Mass Media Competition, Political Competition and Public Policy", mimeo, Institute for International Economic Studies, Stockholm University, and Center for Economic Policy Research.

[30] Thompson, R.S. (1984): "Structure and Conduct in Local Advertising Markets: the Case of Irish Provincial", Journal of Industrial Economics, 33(2), 241-249.

[31] Thompson, R.S. (1989): "Circulation versus Advertiser Appeal in the Newspaper Industry: an Empirical Investigation", Journal of Industrial Economics, 37 (3), 259-271.