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Network Effects in the Press and Advertising Industries

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EFFET DE RÉSEAU CROISÉ ENTRE LES INDUSTRIES DE LA PRESSE ÉCRITE ET DE LA PUBLICITÉ

Résumé : Généralement, les économistes qui s'intéressent à la question des effets de réseau, analysent ces effets quand l'externalité de consommation est créée par la demande pour un bien produit par l'industrie elle-même. Cependant, il est possible de concevoir l'existence d'effets de réseau d'une industrie à une autre. C'est ce qu'il se passe lorsque l'utilité d'un bien produit par une industrie dépend de la taille de la demande pour ce bien produit par une autre industrie. Un exemple particulièrement significatif de ce phénomène réside dans l'interaction entre deux industries, celle de la presse écrite et celle de la publicité. Pour illustrer les conséquences de cet effet de réseau croisé, nous considérons un éditeur en situation de monopole à la fois sur le marché de la presse écrite et sur le marché de la publicité. Sur les deux marchés, on trouve un continu de consommateurs. Sur le marché de la presse écrite, ces consommateurs (lecteurs) changent avec leur disponibilité à payer le journal, mais aussi compte tenu de leur comportement vis-à-vis de la publicité : une partie d'entre eux est publiphile tandis qu'une autre est publiphobe. Sur le marché de la publicité, les annonceurs changent selon leur disponibilité à payer pour un encart publicitaire inséré dans le journal, qui lui même dépend de la taille du lectorat du journal. Nous caractérisons la solution de monopole à partir de deux instruments: le prix du journal et le tarif publicitaire.

NETWORK EFFECTS IN THE PRESS AND ADVERTISING INDUSTRIES

Absract : Generally, economists interested in network effects analyse these effects when the consumption externality created by the demand for the good is produced inside the industry itself. But it can be conceived that network effects take place from one industry to another. This happens when the utility of a good produced in a given industry varies with the size of the demand for a product produced in another industry. A particularly significant example of this phenomenon is provided by the interaction between the media and advertising industries. To illustrate this consequences of this two-sided effects, we consider an editor who is a monopolist both in the press and advertising markets. In both markets, he faces a continuum of customers. In the press industry, these customers (readers) vary according top their willingness to pay for the newspaper, but also with their attitudes toward advertising: some of them are advertising-lovers while the other are advertising-averse. On the adverting market, advertisers vary according to their willingness to pay for an ad in the newspaper, which also depends positively on its readership's size. We characterise the monopoly solution in terms of the monopolist's instruments: the price of the newspaper and the advertising rate.

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Network Effects in the Press and Advertising Industries

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1 Introduction

An industry exhibits *network effects* when the utility of the good exchanged in the industry varies with the size of its demand[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 higher the probability of congestion, the lower the quality of the product and the willingness to pay of consumers. Goods generating snobbish consumption effects 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 first example corresponds to a positive consumption externality while the two others to a negative one.

In all the above examples, the consumption externality is created by the demand for the good produced *inside* the industry itself. But it can be conceived

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[1] An excellent survey of the literature devoted to the network effects in an industry is provided by Katz and Shapiro (1994).

that network effects take place from one industry to another, when the utility of a good produced in a given industry varies with the size of the demand for a product produced in *another* industry. A particularly significant example of this phenomenon is provided by the interaction between the media and advertising industries. Consider for instance the market for printed media. The profits of the editors operating in this market depend on the size of advertising demand: they sell some fraction of their newsprints' surface to the advertisers and the larger the demand for advertising, the higher the share of advertising revenues in their total profits (the remaining share comes from the sales of the printed media to the readership). On the other hand, even if the attitude of media consumers toward advertising cannot be unambiguously ascertained, it is widely recognised that the readership is not neutral to the quantity of advertising contained in the media. While it is generally accepted that TV-viewers are reluctant to advertising (see, for instance, Brown and Rothschild (1993), Danaher (1995), Solomon (1997), Dukes (2000), Anderson and Coate (2000) a.s.o), judgements about readers' attitudes toward *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 first viewpoint, or Musnick(1999) and Sonnac (2000) for the second). It seems that the effective readership of the printed media industry is made of a mixture of consumers who, for some of them, share a positive perception of press advertising while the remaining ones support the opposite view. But the important conclusion for our purpose is that the utility of the readers is, positively or negatively, related to the size of advertising demand, revealing thereby the existence of *network effects* between the printed media and the advertising markets from the viewpoint of the readership as well.

So far, we have only considered a one-sided network effect: the utility of all operators in the printed media market, editors and readers, does depend on the size of demand in the advertising industry. Now we observe that, conversely, *the utility of the advertisers in the latter industry depends as well on the size of demand in the former.* It is clear, indeed, that the larger the readership of a

printed media, the higher the willingness to pay of an advertiser for inserting an ad in this media: the impact of the advertising message increases with the size of the audience ! In conclusion, there exists *two-sided* network effects between the newsprint media and advertising industries: the size of demand in the advertising industry influences the utility of the operators (editors and readers) in the press industry, and the size of demand in the press industry influences the utility of the operators in the advertising market.

In the following, we decompose the pieces of this two-sided interactive mechanism by means of a simple example. In the next section, we consider an editor who is a monopolist both in the press and advertising markets[2]. In both markets, he faces a continuum of customers. In the press industry, these customers (readers) vary according to their willingness to pay for the newspaper or magazine, but also with their attitudes toward advertising: some of them are advertising-lovers while the others are advertising-averse. On the advertising market, customers (advertisers) vary according to their willingness to pay for an ad in the newspaper, which also depends positively on its readership's size. We characterise the monopoly solution in terms of the monopolist's instruments: the price of the newspaper and the advertising rate. This allows us to analyse precisely, under the monopoly market structure, when advertising lowers or increases the newspaper's price charged to the readers. Also it permits to identify when readers ad-repulsion feelings are sufficiently strong to prevent the editor to accept any advertising in his columns.

[2]In this note, we have limited our approach to the analysis of the monopoly case, a situation which is widely observed in the American and European newspapers' markets: "Average local concentration in the daily newspaper industry in the United States has considerably increased during the last century.Whereas there were over 500 cities with competing daily newspapers, there were only 50 in 1980 and less than ten by the late 1990's" Genesove (2000). Similarly, Le Floch(1997) provides the following figure for the French provincial daily newspapers: "the number of provincial daily newspapers has decreased from 175 to 66 between 1945 and 1991". Furthermore, specialists of the press industry view this decrease as one of the weakest among European countries. In particular, Ireland and England have experienced higher decrease rates (see Thompson (1989)). For the analysis of the reasons of concentration in the press industry, see Bagdikian (1980) or Picard (1988).

2 Monopoly

Consider an editor selling as a monopolist a newspaper or a magazine to a population of readers of different types. The editor also sells some proportion of his newspaper's surface to advertisers who buy it for the promotion of their products. Consumers' types t are ranked in the unit interval $[0,1]$ by order of decreasing willingness to pay for reading the magazine. More precisely, we assume that the willingness to pay of a type-t reader is equal to $1-t$. At each point t of the $[0,1]$ -interval, there is a continuum $[0,1]$ of readers of type t, $t \in [0,1]$. This continuum divides into two subsets: a proportion γ of them are *advertising-avoiders* and a proportion $1-\gamma$ *advertising-lovers*. By this we mean that each member of the $\gamma-$fraction (resp. $(1-\gamma)$-fraction) of the population who is an advertising-avoider (resp. lover) looses (resp. gains) in utility when the surface of the magazine devoted to advertising spots increases: the larger the surface sold to advertisers, the larger the loss (resp. gain) incurred when reading the magazine. More precisely, we measure the loss (resp.gain) in utility of each advertising-avoider (resp. advertising-lover) by the number βd when a proportion d of the magazine is sold by the monopolist to advertisers: the parameter β thus measures the intensity of *ad-attraction* when a reader is ad-lover while it measures the intensity of *ad-repulsion* when he is ad-averse[3]. We conclude that the utility of an ad-avoider reader of type t when buying the magazine at price p is equal to

$$1-t-p-\beta d,$$

while the utility of an ad-lover of the same type is equal to

$$1-t-p+\beta d.$$

Now we are in a position to identify the demand function of the monopolist in the readership's market. Define by $t_\alpha(d,p)$ (resp. $t_\lambda(d,p)$) the consumer-type for which the ad-avoiders (resp.ad-lovers) of this type are indifferent between buying

[3]In order to limit the number of parameters, we have assumed that the intensities of ad-attraction and ad-repulsion feelings are the same. There would be no difficulty to extend the analysis by assuming different intensity feelings for ad-lovers and ad-avoiders.

the magazine, or not, at price p, when the proportion of the magazine's surface devoted to advertising is equal to d. It is easily seen that $t_\alpha(d,p)$ (resp. $t_\lambda(d,p)$) is defined by the condition

$$1 - t - p - \beta d = 0$$

(resp.$1 - t - p + \beta d = 0$). Thus we deduce

$$t_\alpha(d,p) = 1 - p - \beta d$$

(resp. $t_\lambda(d,p) = 1 - p + \beta d$). We notice that

$$t_\lambda(d,p) - t_\alpha(d,p) = 2\beta d.$$

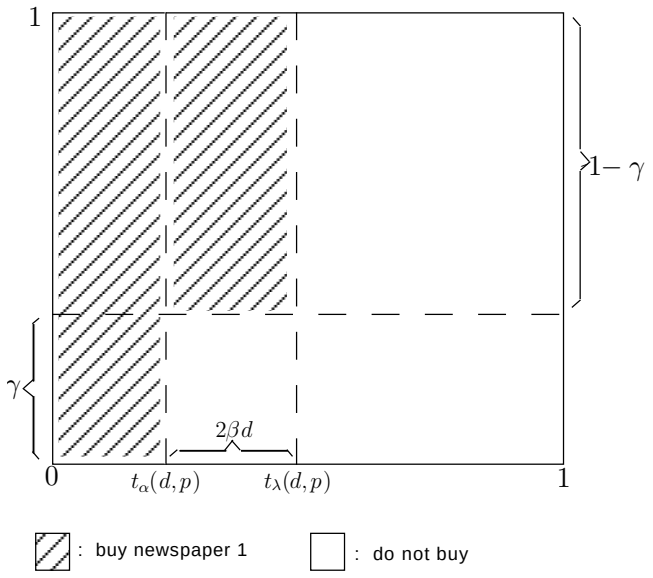

Figure 1: The monopoly demand at price p

The shaded area in figure 1 represents the population of readers who buy the magazine at some price p. It follows from the definitions of $t_\alpha(d,p)$ and $t_\lambda(d,p)$ that all readers located to the left of $t_\alpha(d,p)$ certainly buy the magazine, whether

being ad-avoiders or ad-lovers ; all those to the right of $t_\lambda(d,p)$ do not buy, while those located between $t_\alpha(d,p)$ and $t_\lambda(d,p)$ who are ad-lovers buy the magazine and those who are ad-avoiders do not.

In order to formally identify the algebraic expression for the monopolist's demand function, it is useful to distinguish two cases, according as the proportion γ of ad-avoiders is smaller, or larger, than $\frac{1}{2}$: in the first case, a majority of readers in the population is ad-lover, while a majority is ad-avoider in the opposite case. So, first consider the case $\gamma < \frac{1}{2}$. Then, the monopolist's demand function $D(p,d)$ in the magazine's market writes as

$$\begin{aligned} D(p,d) &= Min\left\{1, t_\alpha(d,p) + (1-\gamma)\left[t_\lambda(d,p) - t_\alpha(d,p)\right]\right\} \\ &= Min\left\{1, 1-p+\beta d(1-2\gamma)\right\} \end{aligned}$$

and is represented on figure 2 below.

Notice that, when the monopoly price reaches a value below $\beta d(1-2\gamma)$, the magazine's market is saturated. When $\gamma > \frac{1}{2}$, the demand function $D(p,d)$ of the monopolist now writes as

$$D(p,d) = Max\left\{0, 1-p-\beta d(2\gamma-1)\right\}$$

and is also represented on figure 2. Notice that, when the monopoly price exceeds the value $1-\beta d(2\gamma-1)$, market demand vanishes.

Total revenue of the editor is not accruing only from his sales in the readership's market, or his *editorial* revenue. Total revenue also includes *advertising* revenue, which comes from his sales of advertising space to advertisers[4]. Consequently, we must also develop a model of the advertising market to analyse demand of advertising space as a function of the advertising rate opposed by the

[4]Here we find the main difference between the press industry and other medias industries, like television or radio broadcasting. Excluding the "pay-per-view" phenomenon, TV or radio broadcasting are free of charge for the listeners or TV-viewers, so that the only receipts of the stations are advertising receipts.

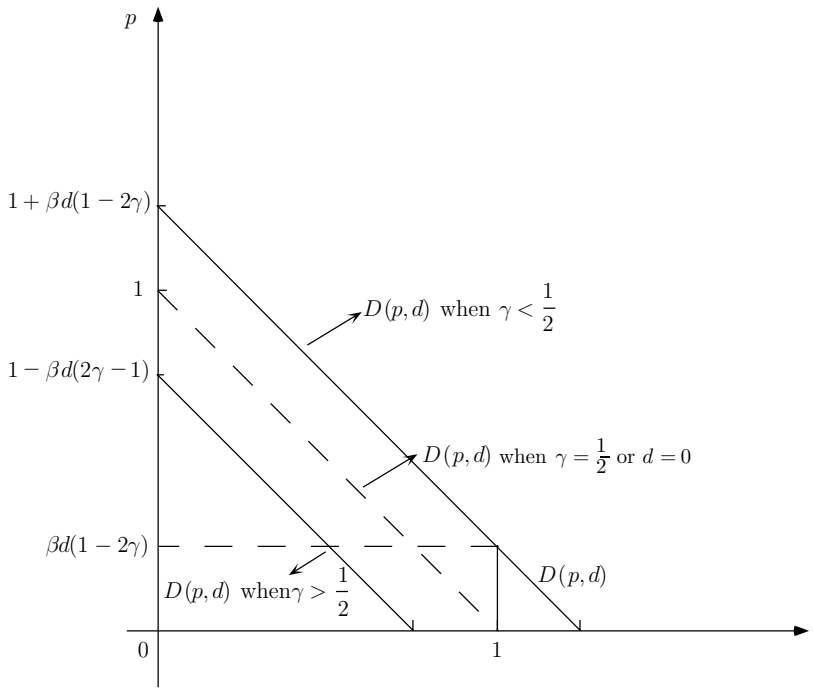

Figure 2: The monopoly demand function

editor in this market. To this end we represent also the population of advertisers by the unit interval $[0,1]$. Advertisers are ranked in this interval by order of increasing willingness to pay for an ad. Ad-insertions are indivisible: either advertiser $\theta, \theta \in [0,1]$, buys a single ad, or does not buy. We assume that the utility of buying an ad in the magazine increases proportionately with the size of its readership. More precisely, we suppose that the utility for advertiser θ of buying an ad in the magazine at a rate s is given by

$$D\theta - s,$$

where D corresponds to the readership of the editor, as it follows from the market demand $D = D(p,d)$ obtained in the newsstand sales market. Now it is easy to derive the demand function of the monopolist in the advertising market. Let

$\theta(s) = \frac{s}{D}$ be the advertiser who is indifferent between buying an ad at tariff s or not buying. The demand function d in the advertising market then simply obtains as

$$d(s, D) = 1 - \frac{s}{D}.$$

The total revenue function of the monopolist thus writes as

$$R(p, s) = pD(p, d) + sd(s, D). \tag{1}$$

This expression clearly reveals the interaction between the two markets -magazine and advertising markets-, due to the two-sided network effects discussed in our introduction. Demand D in the press industry depends on demand d in the advertising market because readers' preferences in the former depend on the size of demand in the latter. Conversely, demand d in the advertising market depends on demand D in the press industry because advertisers' preferences in the former depend on the size of demand in the latter.

In order to identify, from (1), the optimal solution in terms of the monopolist's instruments p and s, it is convenient to distinguish again between the cases $\gamma < \frac{1}{2}$ and $\gamma > \frac{1}{2}$. So let us first consider the case $\gamma < \frac{1}{2}$. Then total revenue $R(p, s)$ writes as

$$R(p, s) = p\left[1 - p + \beta d(1 - 2\gamma)\right] + sd(s, D)$$

when$1 + \beta d(1 - 2\gamma) \geq p \geq \beta d(1 - 2\gamma)$, and

$$R(p, s) = p + sd(s, D)$$

when $\beta d(1 - 2\gamma) > p \geq 0$. To solve the monopolist's problem, let us first identify the optimal value for s. Given a demand level D in the press market, the advertising revenue is equal to $s(1 - \frac{s}{D})$, so that, from the first-order necessary condition, the problem

$$Max_s s(1 - \frac{s}{D})$$

reaches its optimal solution for s^* given by

$$s^* = \frac{D}{2}; \tag{2}$$

furthermore, we get

$$d(s^*, D) = \frac{1}{2}. \tag{3}$$

Substituting (2) and (3) into (1), we obtain

$$R(p, s^*) = p\left[1 - p + \frac{\beta(1-2\gamma)}{2}\right] + \frac{1}{4}\left[1 - p + \frac{\beta(1-2\gamma)}{2}\right] \tag{4}$$

when $1 \geq p \geq \beta d(1-2\gamma)$, and

$$R(p, s^*) = p + \frac{1}{4} \tag{5}$$

when $\beta d(1-2\gamma) > p \geq 0$.

Suppose that the optimal solution p^* to the problem

$$Max_p R(p, s^*)$$

leads to a demand D strictly smaller than 1 in the readership's market. Then p^* must satisfy the first-order condition

$$\frac{dR}{dp} = 1 + \frac{\beta(1-2\gamma)}{2} - 2p - \frac{1}{4} = 0$$

which holds if, and only if,

$$p^* = \frac{3}{8} + \frac{\beta(1-2\gamma)}{4}. \tag{6}$$

To this newspaper's price corresponds an advertising tariff $s^* = \frac{5}{16} + \frac{\beta}{8}(1-2\gamma)$. If the solution to the problem $Max_p R(p, s^*)$ leads to a demand D equal to 1 in the readership's market, then p^* must be the highest price for which this property holds, namely

$$p^* = \frac{\beta(1-2\gamma)}{2}. \tag{7}$$

Substituting (6) into (5), we get in the first case

$$R(p^*, s^*) = \frac{1}{64}\left[5 + 2\beta(1-2\gamma)\right]^2. \tag{8}$$

Similarly, substituting (7) into (6), we obtain in the second case

$$R(p^*, s^*) = \frac{\beta(1-2\gamma)}{2} + \frac{1}{4}.$$

Substracting the second expression above from the first one, we get a function which is quadratic in $y =_{def} \beta(1-2\gamma)$ and vanishes for $y = \frac{3}{2}$. Since the second derivative with respect to y is positive, the difference between the two revenues is a convex parabola which touches the y-axis at $y = \frac{3}{2}$, and is accordingly always non-negative.Thus we deduce that the interior solution (6) dominates the solution (7) leading to readership's market saturation. Also, total revenue in (8) always exceeds the revenue the monopolist would obtain *without operating in the advertising market.* In that case, the readership's market demand would no longer depend on the amount of advertising ($d = 0$) and would be equal to $1 - p$, with revenue $R(p) = p(1-p)$. This revenue is maximal when $p = p^{\circ} = \frac{1}{2}$ with corresponding revenue equal to $\frac{1}{4}$: it is easy to check that (8) always exceeds $\frac{1}{4}$.

It is interesting to compare p^* in (6) with p°. This comparaison leads to the conclusion that

$$p^* \leq p^{\circ} \Longleftrightarrow \beta(1-2\gamma) \leq \frac{1}{2}.$$

Accordingly, when $\gamma \leq \frac{1}{2}$, it is only for small values of the ad-attraction parameter β that advertising serves as a subvention for news' readers since, for values of β exceeding $\frac{1}{2(1-2\gamma)}$, their magazine is more expansive with, than without, advertising. This is not surprising since the condition on γ guarantees that a majority of the readers' population is advertising-lover. With a sufficiently large value of the ad-attraction parameter, the monopoly power of the editor accordingly expands, and allows him to quote a price for the magazine exceeding the monopoly price without advertising. Of course those who pay for this increase of market power are those readers who belong to the minority of ad-avoiders, who not only have to tolerate the existence of ads in their magazine, but, on the top of that, have to pay their magazine at a higher price !

Now we study the optimal solution for the monopolist in the second case, when a majority of the readership is ad-averse ($\gamma > \frac{1}{2}$). Then, total revenue $R(p,s)$ is given by

$$R(p,s) = p\left[1 - p - \beta d(2\gamma - 1)\right] + sd(s,D) \tag{9}$$

when $0 \leq p \leq 1 - \beta d(2\gamma - 1)$, and by

$$R(p, s) = sd(s, D)$$

when $1 - \beta d(1 - 2\gamma) \leq p$. The optimal solution in the advertising market does not depend on the value of γ, and thus obtains as described above, with s^* given by (2) and $d(s^*, D) = \frac{1}{2}$. Substituting these values in (9) we get

$$R(p, s) = p\left[1 - p - \frac{\beta(2\gamma - 1)}{2}\right] + \frac{1}{4}\left[1 - p - \frac{\beta(2\gamma - 1)}{2}\right] \tag{10}$$

when $0 \leq p \leq 1 - \frac{\beta}{2}(2\gamma - 1)$, and

$$R(p, s) = \frac{D}{2} = 0$$

when $1 - \frac{\beta}{2}(1 - 2\gamma) \leq p$. The optimal price p^* obtains as

$$p^* = \frac{3}{8} - \frac{\beta}{4}(2\gamma - 1),$$

which belongs to the domain $\left[0, 1 - \frac{\beta}{2}(2\gamma - 1)\right] \iff \beta(2\gamma - 1) \leq \frac{3}{2}$[5]. To this newspaper's price corresponds an advertising tariff $s^* = \frac{5}{16} - \frac{\beta}{8}(2\gamma - 1)$, which is always strictly positive in the admissible domain in which p^* is positive. Substituting p^* in (10), we get

$$R(p^*, s^*) = \frac{1}{64}\left[5 - 2\beta(2\gamma - 1)\right]^2. \tag{11}$$

Of course, the monopolist has always the opportunity to withdraw from the advertising market, an alternative which could become advantageous when adaversion in the readers' population appears significant. As noticed above, the monopolist then charges the price p° in the news' market, and obtains an editorial revenue equal to $\frac{1}{4}$. Comparing the revenue in (11) with the revenue when using this outside option, we get

$$\frac{1}{64}\left[5 - 2\beta(2\gamma - 1)\right]^2 \geq \frac{1}{4} \iff \beta(2\gamma - 1) \leq \frac{1}{2}.$$

[5] When $\beta(2\gamma - 1) > \frac{3}{2}$, then the optimal price is given by $p^* = 0$, which corresponds to a situation where the newspaper is provided free of charge. In this case, $R(p^*, s^*) = \frac{1}{4}(1 - \frac{\beta(2\gamma - 1)}{2})$. It is easy to check that this value is always smaller than $\frac{1}{4}$, which corresponds to the revenue when the outside option of not participating to the advertising market is selected.

In conclusion, when $\gamma > \frac{1}{2}$ and $\beta(2\gamma - 1) \leq \frac{1}{2}$, the optimal monopoly solution is provided by (11), with the monopolist active in the advertising market. On the contrary, when $\gamma > \frac{1}{2}$ and $\beta(2\gamma - 1) > \frac{1}{2}$, the editor exerts his outside option, refrains from selling any advertising space and quotes the price p° in the news market[6]. In this case, ad-repulsion is so strong among the readers that it ceases to be profitable to introduce a price discount in this market in order to increase market share and thereby attract more advertisers ; on the contrary, it is more profitable to fully concentrate on editorial receipts, which then allows the monopolist to use the price p^0. Now we notice that, when the majority of the readership consists of ad-avoiders, and the interior solution $p^* = \frac{3}{8} - \frac{\beta}{4}(2\gamma - 1)$ prevails, the price of the magazine is always smaller than the price p° which would obtain if the monopolist would be inactive in the advertising market. In this case, the minority of advertising-lovers not only enjoy the advertising outlets in their magazine, but also benefit from the price-discount due to the existence of a majority of ad-avoiders. Also notice that the monopoly advertising tariff is an increasing(resp.decreasing) function of the intensity of readers' ad-attraction feelings (resp. ad-repulsion feelings).

3 Conclusion

In this paper, we have considered an editor who is a monopolist both in the press and advertising markets. Taking into account the interaction between these two markets resulting from the network effects existing between them, we have characterised the monopoly solution on each of these markets in terms of the two monopolist's instruments: the price of the newprint and the advertising rate. Our analysis sheds light, for the monopoly case, on a natural question formulated in the literature devoted to the printed media industry: does advertising

[6]Notice that the domain of values of the ad-repulsion parameter β for which this second alternative is the optimal one, is non-empty. It includes all values of β in the interval $\left[\frac{1}{2(2\gamma-1)}, \frac{3}{2(2\gamma-1)}\right]$ for which the interior solution p^* exists, but is dominated by the outside option.

lower the prices of newspapers and magazines[7] ? It appears that the answer to this question should be nuanced according to the readership's attitude toward advertising. When readers are, in majority, ad-lovers, it is only when ad-attraction is weak that advertising implies a price discount for the readers, compared with the newspaper's price they would be charged without advertising. This is due to the fact that strong ad-attraction increases the monopoly power of the editor, and allows him to quote a price for the magazine exceeding the monopoly price without advertising. On the contrary, when readers are, in majority, ad-avoiders, the price of the magazine is always lower with, than without, advertising. However, when the intensity of ad-aversion is high enough, the monopolist prefers to exert his outside option and refrain from devoting any surface of the media to advertising support.

It appears that there are close similarities between the problem which we study in this note and the questions which are at the heart of the literature dealing with goods for which consumers' preferences depend on the clientele size. There exists a wide body of literature on network goods (Katz and Shapiro (1994)) as well as a strand of literature on situations when consumer behavior is characterized by conformity or vanity (see for instance the recent paper by Grilo, Shy and Thisse (2001)). In our framework, the utility which readers derive from reading their newsprint depends, positively or negatively, on the number of advertisers who choose this media for advertising purposes. On the other hand, the revenue which advertisers can expect to obtain when inserting an ad in the newspaper is increasing with the number of its readers. However, the problem is more complicated here than in the literature we referred to above since there are now two distinct sets of customers, and the monopolist has to set two different prices in two different markets, instead of one in a single market. Yet the problems, and the techniques for solving them, are quite similar since, given the price set by the monopolist, the decisions of the consumers are interdependent, i.e. the decision of a particular reader of buying the newspaper (resp. the decision of a particular advertiser of inserting an ad in the newspaper) depends on the

[7]On this question, see, for instance, Soley, and Krishnan (1987) and Soley (1989). See also Kaldor (1950) and Telser (1996).

decisions which are taken by the advertisers (resp. the readers).

In this note, we have limited our approach to the analysis of the monopoly case, a situation which is widely observed in the American and European newspapers' markets (see footnote 2 above). Yet most of the existing literature on network effects in a single industry envisages situations of competition between a few sellers. Thus, it would be natural to extend the above analysis to the case of several editors competing both in the printed media and advertising industries. It is along this line that we plan to pursue our exploration of this fascinating subject in a forthcoming paper.

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