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Does Advertising Lower the Price of Newspapers to Consumers ? A Theoretical Appraisal

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Keywords: press industry, media, network effects

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Résumé

Dans ce papier, nous étudions la question de la subvention du prix des journaux par la publicité. Nous le faisons au départ d'un modèle des effets de réseaux croisés entre le marché de la publicité et le marché des médias, et nous montrons que la réponse doit être nuancée selon la réaction des consommateurs vis-à-vis de la publicité.

Mots clés : industrie de la presse, économie des médias, network effects
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1. An interesting question raised by Soley and Krishnan (1987) is whether advertising lowers the price of newspapers to consumers. The empirical studies that these authors have conducted reveal that the impact of advertising on daily newspapers' prices is not easy to identify. In the present note, we propose, for the monopoly case, a theoretical approach to the same question based on the notion of *two-sided network effects*[1]. An industry exhibits network effects when the utility of the good exchanged in the industry varies with the size of its demand. In most examples considered in the literature, the consumption externality is created by the demand for the good produced *inside* the industry itself. But it can be conceived 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[2].

A particularly significant example of this phenomenon is provided by the interaction between the market for printed media and the advertising industry. 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. 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 viewers are reluctant to advertising, 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. Thus, readers' utility 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 market from the viewpoint of the readership as well.

On the other hand, 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.

2. 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. Consumers' types t are ranked in the unit interval $[0,1]$ by order of decreasing willingness to pay for the magazine, which is assumed to be 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. 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. We conclude that the utility of an ad-avoider reader of type t when buying the magazine at price p is equal to

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

[1] 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 Genesove (2000), Le Floch(1997), Kaitatzi-Witlock (1996)).

[2] Cross-network externalities taking place between two different industries have been analysed in the recent literature devoted to *two-sided markets :* see Rochet and Tirole (2003) and Armstrong (2002).

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 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. $t_\lambda(d,p) = 1 - p + \beta d$).

To 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 $\frac{1}{2}$. 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

$$\begin{aligned} D(p,d) &= (1-\gamma)t_\lambda(d,p) \\ &= (1-\gamma)(1-p+\beta d) \end{aligned}$$

when $p > 1 - \beta d$ and

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

when $0 \leq p \leq 1 - \beta d$. The function $D(p,d)$ is represented on figure 1 below.

Figure 1: The monopoly demand function

First, notice that when the monopoly price exceeds $1 - \beta d$, no ad-avoider buys the newspaper [3].Notice also 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 writes as

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

and is also represented on figure 1. 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. Consequently, we develop a model of the advertising market to

[3]For avoiding that the monopolist selects a price leading to eliminate ad-avoiders' readers from the market, we shall assume in the sequel that $\beta < \frac{5}{6}$: this assumption guarantees that it is never optimal for the monopolist to eliminate all ad-avoiders' readers. Without loss of generality, we shall henceforth restrict our attention to the range of prices in the domain $[0, 1 - \beta d]$.

analyse demand of advertising space as a function of the advertising rate opposed by the 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. 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 for 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

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

Total revenue function thus writes as

$$R(p,s) = pD(p,d) + sd(s,D).$$

In order to identify 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

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

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

$$R(p,s) = p + sd(s,D) \tag{2}$$

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

$$s^* = \frac{D}{2}; \tag{3}$$

furthermore, we get

$$d(s^*,D) = \frac{1}{2}. \tag{4}$$

Substituting (3) and (4) into (1) and (2), we obtain

$$R(p,s^*) = p\left[1 - p + \frac{\beta(1-2\gamma)}{2}\right] + \frac{1}{4}\left[1 - p + \frac{\beta(1-2\gamma)}{2}\right] \tag{5}$$

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

$$R(p,s^*) = p + \frac{1}{4} \tag{6}$$

when $\beta d(1-2\gamma) > p \geq 0$. In appendix 1, we show that the optimal monopoly solution obtains as

$$p^* = \frac{3}{8} + \frac{\beta(1-2\gamma)}{4}; s^* = \frac{5}{16} + \frac{\beta}{8}(1-2\gamma) \tag{7}$$

so that

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

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 $\frac{1}{4}$.

A direct comparison of p^* in (7) with p° leads to the following conclusion:

Proposition 1. *With a majority of ad-lovers ($\gamma \leq \frac{1}{2}$), advertising serves as a subsidy to news' readers if, and only if*

$$\beta(1-2\gamma) \leq \frac{1}{2}.$$

Consequently, when $\gamma \leq \frac{1}{2}$, it is only for small values of the ad-attraction parameter β that advertising subsidises consumer news' prices since, for values of β exceeding $\frac{1}{2(1-2\gamma)}$, their magazine is more expensive with, than without, advertising[4]. 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 (3) 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

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

[4]For $\gamma < \frac{1}{5}$, there exists $\beta-$values satisfying the constraints $\frac{5}{6} > \beta > \frac{1}{2(1-2\gamma)}$.

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 ad-aversion 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

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

The following proposition summarizes the above findings.

Proposition 2. *When there is a majority of ad-averse readers ($\gamma > \frac{1}{2}$ and ad-aversion is weak ($\beta(2\gamma - 1) \leq \frac{1}{2}$, the optimal monopoly solution is $p^* = \frac{3}{8} - \frac{\beta}{4}(2\gamma - 1)$, with the monopolist active in the advertising market. When $\beta(2\gamma - 1) > \frac{1}{2}$, the monopolist refrains from selling any advertising space and quotes the price p° in the news market*[6].

In the second case covered by proposition 2, ad-repulsion is so strong 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 prevails, the price of the magazine is always smaller than the price which would obtain if the monopolist would not be active 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.

3. The above analysis sheds light, for the monopoly case, on a natural question formulated in the literature devoted to the printed media industry : does advertising lower the prices of newspapers and magazines ? 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 refrain from devoting any surface of the media to advertising support.

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[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.

[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.

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1 Appendix

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,

$$p^* = \frac{3}{8} + \frac{\beta(1-2\gamma)}{4}. \tag{A1}$$

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

$$p^* = \frac{\beta(1-2\gamma)}{2}. \tag{A2}$$

Substituting (A1) into (5), we get in the first case

$$R(p^*, s^*) = \frac{1}{64}\left[5 + 2\beta(1-2\gamma)\right]^2. \tag{A3}$$

Similarly, substituting (A2) 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 (A1) dominates the solution (A2) leading to readership's market saturation.Q.E.D.