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Theory and Evidence from the Newspaper Industry**

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Price Discrimination in a Two-Sided Market: Theory and Evidence from the Newspaper Industry*

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Abstract

We investigate theoretically and empirically the determinants of second-degree price discrimination in two-sided markets. We build a model in which a newspaper must attract both readers and advertisers. Readers are uncertain as to their future benefit from reading, and heterogeneous in their taste for reading. Advertisers are heterogeneous in their outside option, taste for subscribers, and taste for occasional buyers. To estimate empirically the effect of the advertisers' side of the industry on price discrimination on the readers' side, we use a "quasi-natural experiment". We exploit the introduction of advertisement on French Television in 1968, which we treat as a negative shock on advertisement revenues of daily national newspapers (treated group), but not on daily local newspapers (control group). We build a new dataset on French local newspapers between 1960 and 1974 and perform a Differences-in-Differences analysis. We find robust evidence of increased price discrimination as a result of a drop in advertisement revenues.

JEL: L11, M13

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1 Introduction

The newspaper industry is a canonical example of a two-sided market. Most newspapers attract two distinct groups of consumers: readers and advertisers. Since each group of consumers possibly cares about the presence and characteristics of the other group (say advertisers care about the number of readers), pricing policies are more subtle than in better-understood one-sided industries. Another salient feature of this industry is the price discrimination between subscribers and occasional buyers: subscribers are typically charged a lower per issue price than occasional buyers, and these price differences appear not to be explained entirely by differences in costs. In this paper, we investigate – both theoretically and empirically – how the reliance on advertisement revenues affects the incentives newspapers have to engage in second-degree price discrimination on the readers’ side.

Improving our understanding of newspapers’ pricing policies on the readers’ side, and in particular how these are determined by advertisement considerations, is of importance given the current debate surrounding this declining industry. The state of distress of the newspaper industry is indeed often attributed to the drop in advertisement revenues that followed the advent of Internet. This crisis begs the question of the nature of the optimal government intervention (if any), and raises several antitrust issues as well (such as mergers, appropriate tests of market power, etc). We hope to inform this debate by identifying and quantifying the channels through which the two-sidedness of the industry affects the pricing policy of newspapers, and in particular the standard incentives they may have to price discriminate between readers. To this end, we first extend recent models of multisided industries to incorporate the scope for second-degree price discrimination. Our first contribution is thus theoretical in nature. Second, we carry an empirical analysis using a new dataset on the French local newspaper industry that we build from archives data.

In the theory part of our project we build a general model of a two-sided market in which a monopolist newspaper must attract both readers and advertisers (in the spirit of Rochet and Tirole (2003) and Weyl (2010)). In particular, we consider the (repeated) interaction between a newspaper, a continuum of readers, and a continuum of advertisers. Newspapers can be bought by readers either by subscription or at the newsstand on a day-by-day basis. Beyond differences in delivery costs the first fundamental reason for price discrimination on the reader side is uncertainty and consumer heterogeneity. Consumers (i) are uncertain about their future willingness to read the newspaper in future periods and (ii) are heterogeneous in their average taste for reading the newspaper. The newspaper exploits both the readers’ uncertainty and heterogeneity by offering newspaper issues either on subscription before consumers’ uncertainty is resolved, or at newsstands once consumers know their realized valuation for the good. High-valuation consumers subscribe to the newspaper at a discounted price prior to knowing their exact day-by-day basis valuation for reading the newspaper. Low-valuation consumers instead buy the newspaper at a high newsstand price whenever they have a high willingness to read the newspaper. This rationale for price discrimination was first put forward by Glazer and Hassin (1982), but in a model without advertisers. Adding the advertisers’ side to the model – that is, considering a two-sided market – is therefore the first contribution of our project. We model advertisers as being heterogenous in (i) their taste for subscribers, (ii) their taste for unit/occasional buyers, and (iii) their outside option (their payoff when placing ads on alternative platforms, such as other newspapers, television, internet, etc). Since even absent advertisers it may be optimal for the newspaper to engage in price discrimination, the challenge is to disentangle how the two-sidedness of the industry affects the scope for price discrimination. In such a framework we characterize the optimal pricing formulas of the

newspaper, as well as the readers and advertisers' demands. These formulas are intuitive and in the spirit of Weyl (2010). When choosing its prices, aside from taking into account the various marginal costs and demand elasticities (own and cross), the newspaper must cater to (i) the average taste of marginal readers (those indifferent between subscribing or buying occasionally on the one hand, and those indifferent between buying occasionally or never on the other) and (ii) the average tastes of marginal advertisers (those indifferent between placing an ad or not) for both subscribers and non subscribers, as well as their outside options. The main virtue of such a general approach lies in that we are able to identify which ingredients are relevant, thereby guiding our empirical analysis.

We also aim at providing some comparative statics. We are particularly interested in the impact on the extent of price discrimination of an increase in the outside option of advertisers, say triggered by the advent of internet or the introduction of advertisement on television. In a simplified model we show that such a shock leads to an increase in the prices charged to readers. Indeed, since less surplus may be extracted from advertisers—and assuming that advertisers prefer more eyeballs to less—the newspaper will cater less to the advertisers' taste for large readerships and instead increase its margin on the readers' side (as empirically observed in Seamans and Zhu (2012)). On the other hand, whether the newspaper moves towards a more subscriber-based readership is a priori unclear as it depends also on the average profile of the newly relevant marginal advertisers (and in particular their average taste for subscribers versus non-subscribers).

On the empirical side, the main empirical challenge is to isolate the “advertisement” effect on price discrimination. To this end, we follow an empirical strategy in the spirit of an event study. We exploit the introduction of advertising on French Television in October 1968 as an exogenous negative shock on the advertising side of newspapers. Television is state-owned in France from 1945 and 1981; there is thus no interaction between TV owners and newspapers' owners. Moreover, the introduction of advertising on TV was decided by law, despite strong resistances by the newspaper industry. It can thus be considered as strictly exogenous with respect to newspapers' pricing policies. The introduction of advertisement leads to an exogenous shock that shifts exclusively the incentives to price discriminate stemming from advertisement revenues. Indeed, reader heterogeneity and the marginal costs of producing and delivering newspapers are not affected by this introduction. To the best of our knowledge, we are the first to use this “quasi-natural” experiment.

Our identifying assumption is that the negative shock on advertisement revenues has affected national daily newspapers, but not local daily newspapers. Indeed, while national newspaper advertisement consists mostly of commercial ads that are relatively close substitutes to those broadcasted on television (national brands, etc), a large share of advertisement in local newspapers is instead local in nature (local commercial ads and classified ads). We thus use national newspapers as our “treated group”, and local newspapers as our “control group”. Using novel annual data on local and national newspapers between 1960 and 1974, we compare the pre-1968-to-post-1968 change in price discrimination by national daily newspapers to the change in price discrimination by local daily newspapers over the same period (Difference-in-Difference estimation). We find that the decrease in advertisement revenues leads to a decrease in the price ratio, i.e., a decrease in the extent of price discrimination. Our results are robust to a range of alternative specifications and controls. In particular, they are robust to controlling for industry-specific time trends, and to allowing for flexible time-varying effects of the negative shock on advertisement revenues (Laporte and Windmeijer, 2005).

Literature Review This paper first contributes to the empirical literature that examines the determinants of price discrimination. A growing number of papers investigate the role of competition. Seminal contributions include Borenstein (1991) on retail gasoline markets and Borenstein and Rose (1994) on airline tickets. More recent articles include Busse and Rysman (2005) who investigate pricing in Yellow pages advertising, Gerardi and Shapiro (2009) who reexamine air ticket price discrimination, Dai et al. (2012) who study the non-monotonicity of the effect of competition on price discrimination using data from the U.S. airline, and Seim and Viard (2011) who study nonlinear pricing in cellular telecommunication markets. This paper also aims at contributing to the growing body of research on price discrimination that uses structural analysis approaches (McManus, 2007). All these articles study one-sided markets, while ours aims precisely at understanding the two-sided market effect on price discrimination. There also exists a very recent vein of research that examines the role of consumers' bounded rationality on price discrimination via subscription (see Grubb (2012) for an insightful review). Prominent contributions to this literature are DellaVigna and Malmendier (2004) for contracts in health sport centers and Grubb (2009) for cellular phone service plans. Although we recognize that bounded rationality may play a role in consumers' decision as to subscribe or not to a newspaper, the scope for price discrimination in our model instead stems from informational considerations. In addition, our aggregated data do not allow us to investigate this issue. Finally Clerides (2004) discusses the definition of price discrimination when products are differentiated. This is of particular importance to us. Indeed, we are considering here identical newspapers but whose cost of production – through the cost of delivery – can vary depending on whether the reader is a unit buyer buying in a newsstand or a subscriber. We argue that at least part of the price differences we observe cannot be explained by delivery cost differences, as suggested by our difference-in-differences analysis. Our paper builds more specifically on Glazer and Hassin (1982) who first study price discrimination by a newspaper based on consumers uncertainty. We introduce the advertising side in the profit function of the newspapers and discuss how this aspect modifies prices on the reader side.

Our paper also relates to the literature on two-sided markets. To the best of our knowledge, Liu and Serfes (2010) is the only paper investigating price discrimination in two-sided markets. However, their modeling approach does not fit well with the newspaper industry as they consider perfect price discrimination on both sides and in a Hotelling framework. Our paper is closely related to several seminal papers on two-sided markets (without price discrimination). Rochet and Tirole (2003) provide a widely applicable model of two-sided markets and discuss markets for advertising, credit cards, software and web portal usage. Weyl (2010) and White and Weyl (2010) further extend two-sided market models. We contribute to this recent line of research by introducing second-degree price discrimination on one side of the market. Anderson and Coate (2000) study broadcast markets in which retailers pay for advertising to reach consumers, and where consumers dislike advertising. Rysman (2004) provides an empirical analysis of the market for yellow pages. Further, Seamans and Zhu (2012) look at the impact of the entry of Craig's list on local newspapers' pricing policies. They find that this negative shock on the advertisement side of newspapers had led to an increase in subscription prices. Jin and Rysman (2013) study US sports card conventions pricing through the lens of the two-sided market theory. Finally, Fan (2011) endogenizes newspapers quality in a discrete choice model to better assess merger effects. Naturally, much work on two-sided markets has focused on the Media Industry. Berry and Waldfogel (1999) for instance analyze the effects of entry by radio stations. Argentesi and Filistrucchi (2007) develop an analysis to estimate market power in two-sided markets. While they also consider the newspaper

industry (Italy), they do not focus their attention on second-degree price discrimination as they lack data on subscription prices. Finally, their period of interest (1976-2003) is longer than ours, but our sample of newspaper is significantly larger. There is also a line of research investigating whether consumers of Media like/dislike advertising (it is typically assumed in theoretical analyses that consumers dislike advertising). Kaiser and Song (2009) for instance use data on German consumer magazines (between 1992 and 2004) to analyze the extent to which consumers (dis-)like advertising.

Finally and more generally, this research project is a contribution to the empirical literature on media using historical data to understand the evolution of the newspaper industry and its impact on society. In a paper investigating the effect of newspapers entry and exit, Gentzkow et al. (2011) find that newspapers have a robust positive effect on political participation in the United States. (Cagé, 2013) instead shows that increased competition may have a negative effect on participation. In their recent work on competition and ideological diversity Gentzkow et al. (2012) estimate a model of newspaper demand, entry, and political affiliation choice, in which newspapers compete for both readers and advertisers.

The remainder of the paper is organized as follows. Section 2 develops a model of second-degree price discrimination by a platform. In Section 3 we estimate the effect of the advertising side of newspapers on price discrimination on the reader side using a Differences-in-Differences analysis based on the introduction of advertising on French Television in 1968. Section 4 concludes.

2 A Model of Second-Degree Price Discrimination by a Platform

2.1 Set-up

To model the newspaper industry we consider the repeated interaction between a newspaper, a continuum of readers of mass one (side R of the industry), and a continuum of advertisers of mass one (side A). In the following we denote S the subgroup of readers subscribing to the newspaper, and K the subgroup of occasional buyers (where K stands for "Kiosk"). Finally, the newspaper sells n issues during the length of period of interest, which we take as given.

Newspaper. The profit-maximizing newspaper chooses (i) which price p to charge occasional unit buyers, (ii) which price nh to charge subscribers to have the newspaper delivered to their home for the n issues and (iii) which price nt to charge advertisers to have their ad be placed for n issues. The marginal cost of serving unit buyers is denoted c_K , that of serving subscribers is c_N , and, finally, that of serving advertisers is c_A . We do not model the actual production of news, and thus implicitly assume that the newspaper produces content that is of interest to at least some readers.

Readers. The gross payoff to reader i from reading the newspaper at date t is given by:

$$U_{i,t} = \theta_i + \epsilon_t, \tag{1}$$

where θ_i represents an individual specific taste for reading, while ϵ_t captures a common shock to all readers at date t (say elections, sport competitions, etc).¹ We assume that θ has support going from minus infinity to plus infinity, and is drawn according to $f^R(\theta)$. Furthermore, ϵ_t

¹We thus disregard externalities stemming from the presence of ads.

takes value x with probability $\frac{1}{2}$, and zero otherwise. Reader i , if she has not subscribed, observes the realization of ϵ *before* deciding whether to purchase the newspaper at date t . Not subscribing thus allows readers to make informed purchasing decisions.

For a given subscription price h per issue (i.e., the actual subscription price is nh), and prior to observing the n future realizations of ϵ , reader i 's expected utility from subscribing is:

$$U^S(\theta_i, h, n) = n \left(\theta_i + \frac{x}{2} - h \right). \quad (2)$$

The subscriber pays nh *upfront* to have the n issues delivered at home, and thus read all n issues (since $x > 0$ by assumption), where the expected gross benefit per issue is $\theta_i + \frac{x}{2}$.

A reader i 's expected utility from occasionally buying the newspaper at the newsstand price p per issue is instead given by is:

$$U^K = \begin{cases} n \left(\theta_i + \frac{x}{2} - p \right), & \text{if } \theta_i \geq p \\ \frac{n}{2} \left(\theta_i + x - p \right), & \text{if } p > \theta_i \geq p - x \\ 0, & \text{if } p - x > \theta_i \end{cases} \quad (3)$$

Recall first that non-subscribers make their purchasing decisions at date t knowing the realization of ϵ_t . Readers that have a very high taste for reading (that is, readers for which $\theta_i \geq p$) always buy the newspaper; their expected gross benefit per issue is thus again $\theta_i + \frac{x}{2}$. Buyers with instead an intermediary taste for reading (that is, readers for which $p > \theta_i \geq p - x$) only buy the newspaper when the shock ϵ_t is positive (i.e., when $\epsilon_t = x$). The expected number of purchases made by these readers is thus $\frac{n}{2}$; and their gross payoff when the shock is positive is equal to $\theta_i + x$. Finally, readers with a very low taste for reading never buy the newspaper.

Advertisers. We assume that advertisers choose between either placing an ad in the newspaper for n periods at price nt or never placing an ad. The gross payoff to advertiser j of placing an add for n periods is taken to be $V_j = nb_j^S N^S + nb_j^K N^K$, where b_j^S captures advertiser j 's taste for the average number of subscribers per period N^S , while b_j^K captures his taste for the average number of non-subscribers per period N^K . In addition, advertiser j has outside option $n\alpha v_j$. The 3-tuple (b_j^S, b_j^K, v_j) is drawn according to the joint pdf $f^A(b^S, b^K, v)$, where each parameter is drawn from support going from minus infinity to plus infinity. We assume away any price discrimination by the newspaper on the advertisers' side of the industry (i.e., all advertisers face price nt).

We thus have that advertiser j places an ad in the newspaper for n issues at unit price t if and only if:

$$V_j = nb_j^S N^S + nb_j^K N^K - nt \geq n\alpha v_j. \quad (4)$$

One can already anticipate that the advertisers' taste for large readerships may induce the newspaper to set prices "artificially" low on side R so as to attract many readers (i.e., more than in a world without advertisement) and in turn charge high prices to advertisers. If prices charged to readers are below the relevant marginal costs, advertisers *de facto* subsidize readers. The parameter α captures the supply of alternative platforms to advertisers. These alternative platforms could be other newspapers (therefore treated in a reduced form) or, in the spirit of this paper, the television. It is reasonable to think that the introduction of advertisement on television leads to an increase in α .

2.2 Solving the Model

We first compute the three relevant demand functions; that is, the demand for subscriptions, the average demand per issue of newspapers at the newsstand, and the demand for advertisement slots.

Readers. As long as $p > h$, when comparing payoffs (3) and (2), one derives that high-valuation readers subscribe and average ones instead buy occasionally.² In particular, we have that the demand by subscribers is equal to:

$$N^S = \int_{2h-p}^{\infty} f^R(\theta) d\theta. \quad (5)$$

Rather intuitively, more readers are willing to subscribe to the newspaper when the subscription price nh decreases and/or the unit price p increases. The demand by unit buyers is instead given by:

$$N^K = \int_{p-x}^{2h-p} f^R(\theta) d\theta, \quad (6)$$

which is decreasing the unit-price p but increasing in the subscription price nh .

Readers with a high taste for reading would buy every issue of the newspaper at the newsstand at price p (even when $\epsilon_t = 0$) if subscribing was not possible. Since subscribing is instead possible, and since $h < p$, these readers prefer subscribing to enjoy the lower average price. Readers with an average taste for reading instead have a low enough gross payoff when $\epsilon_t = 0$ that it is not interesting for them to have all n issues be delivered to their home; they prefer buying it only when $\epsilon_t = x$, even though the per issue price p is higher. Here lies the scope for price discrimination. Setting $h < p$ means extracting less surplus from the readers with a rather high taste for reading (those who would have bought the newspaper at the newsstand anyway), but allows the platform to extract more surplus from the informed consumers; i.e., those who buy only when $\epsilon_t = x$. It is thus these informational differences that the newspaper exploits through second-degree price discrimination. In other words, it is not the presence of advertisers that explains the existence of price discrimination in this model; though advertisers will certainly affect its extent.

Advertisers. On the other side of the industry, we have that the demand by advertisers is given by:

$$N^A(N^S, N^K, t, \alpha) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\frac{1}{\alpha}(b^S N^S + b^K N^K - t)} f(b^S, b^K, v) dv db^S db^K, \quad (7)$$

Advertisers are more willing to place their ads in the newspaper as the average number of readers increases (both subscribers and non-subscribers), as the price of advertisement nt decreases, and as their outside option decreases. The pricing policy of the newspaper must thus take into account these *network effects* when choosing prices on the readers' side.

²Observe that it is weakly suboptimal for the newspaper to set $p < h$ (and having no readers subscribe) since the same outcome can be guaranteed by setting $p = h$. Furthermore, we implicitly assume that it is in fact optimal to set $p > h$. In the simplified model we provide in Subsection ..., we provide a condition such that this is indeed the case.

The newspaper's problem. Having characterized the relevant demands, the newspaper's profits are equal to:

$$\begin{aligned}\Pi &= \Pi^S + \Pi^K + \Pi^A \\ &= \frac{n}{2} (p - c^K) N^K(h, t) + n (h - c^S) N^S(h, t) + n (t - c^A) N^A(N^S, N^K, t, \alpha)\end{aligned}\quad (8)$$

The newspaper chooses h , p , and t to maximize (8). In the following proposition let ϵ_h^S denote the elasticity of the subscribers' demand with respect to the subscription price h , ϵ_h^K that of the unit buyers' demand with respect to the unit price p , etc.

Proposition 1 *The optimal pricing policy of the newspaper is characterized by the following three pricing formulas:*

$$\frac{h - c^S}{h} = -\frac{1}{\epsilon_h^S} - \frac{1}{2} (p - c^K) \frac{\partial N^K}{\partial h} \frac{1}{N^S} \frac{1}{\epsilon_h^S} - (t - c^A) \frac{\partial N^A}{\partial h} \frac{1}{N^S} \frac{1}{\epsilon_h^S} \quad (9)$$

$$\frac{p - c^K}{p} = -\frac{1}{\epsilon_p^K} - 2 (h - c^S) \frac{\partial N^S}{\partial p} \frac{1}{N^K} \frac{1}{\epsilon_p^K} - 2 (t - c^A) \frac{\partial N^A}{\partial p} \frac{1}{N^K} \frac{1}{\epsilon_p^K} \quad (10)$$

$$\frac{t - c^A}{t} = -\frac{1}{\epsilon_t^A}. \quad (11)$$

Proof. Differentiating (8) with respect to h yields:

$$N^S + (h - c^S) \frac{\partial N^S}{\partial h} + \frac{1}{2} (p - c^K) \frac{\partial N^K}{\partial h} + (t - c^A) \frac{\partial N^A}{\partial h} = 0, \quad (12)$$

where

$$\frac{\partial N^A}{\partial h} = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f \left(b^S, b^K, \frac{1}{\alpha} (b^S N^S + b^K N^K - t) \right) \left(\frac{1}{\alpha} \left(b^S \frac{\partial N^S}{\partial h} + b^K \frac{\partial N^K}{\partial h} \right) \right) db^S db^K.$$

Note that this is nothing else than the average marginal change in payoff of the marginal advertisers (those exactly indifferent between placing an ad or not). One may rewrite (12) as follows:

$$h = c^S \frac{\epsilon_h^S}{1 + \epsilon_h^S} - \frac{1}{2} (p - c^K) \frac{\epsilon_h^K}{1 + \epsilon_h^S} \frac{N^K}{N^S} - (t - c^A) \frac{\epsilon_h^A}{1 + \epsilon_h^S} \frac{N^A}{N^S}.$$

Similarly, differentiating (8) with respect to p and rearranging yields (10), while differentiating (8) with respect to t yields (11). ■

Intuition. These pricing formulas are Lerner pricing formulas modified to take into account the scope for price discrimination within readers as well as the presence of advertisers. These pricing formulas, as well as the three demand functions, help us gain a good intuition for the newspaper's prices. In addition to taking into account the various marginal costs and elasticities, the newspaper chooses its prices on the readers' side taking into account (i) the average marginal change due to a change in prices charged to readers in the payoff of the marginal advertisers (those indifferent between placing an ad or not), as well as (ii) the incentives for

non-subscribers to become unit buyers, and finally the incentives for non-subscribers to stop purchasing altogether. Not surprisingly, we also observe that the relative sizes of each group of consumers matters as well. Finally, note that the formula for the advertisement price is nothing else but the standard Lerner pricing formula (since externalities from advertising on readers are for now disregarded).

In addition to this, these formulas also offer us insights directly linked to the empirical analysis carried out in this paper. Note first that

$$\frac{\partial N^A}{\partial h} = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f \left(b^S, b^K, \frac{1}{\alpha} (b^S N^S + b^K N^K - t) \right) \left(\frac{1}{\alpha} \left(b^S \frac{\partial N^S}{\partial h} + b^K \frac{\partial N^K}{\partial h} \right) \right) db^S db^K.$$

is equal to the average marginal change in payoff of the marginal advertisers (those exactly indifferent between placing an ad or not), scaled by the common component of their outside option. This implies that an increase in the outside option following, say, the introduction of advertisement on TV, affects the *extent* of price discrimination through a *composition effect*, i.e., through a change in the average "type" of marginal advertisers. The second effect is, in a sense, less subtle: a change in the outside option of advertisers also changes the price the newspaper can charge them (it decreases it). Because of this effect, all else equal, the newspaper will distort less the prices charged to readers. Finally, the magnitude of these two effects is affected by the relative sizes of the groups of subscribers and non-subscribers (as well as the absolute value of their own price elasticity of demand.)

2.3 A Simple Model

The main virtue of the general framework presented in the previous subsection is to identify the relevant economic factors that determine a newspaper's pricing policy. To gain further intuition, and to carry out comparative statics, we however simplify the framework presented so far in several ways. We first suppose that $\theta_i \sim U [0, \bar{\theta}]$. This implies that the revenues from subscribers become:

$$\Pi^S = nh \left(\frac{\bar{\theta} - (2h - p)}{\bar{\theta}} \right), \quad (13)$$

while those from unit purchases are instead given by:

$$\Pi^K = \frac{np}{2} \left(\frac{(2h - p) - (p - x)}{\bar{\theta}} \right) = \frac{np}{\bar{\theta}} \left(h - p + \frac{x}{2} \right). \quad (14)$$

Next we further simplify the framework by assuming that all advertisers care about is *the average number of readers per issue*, i.e., $V_j = nN^R$, where $N^R = \frac{\bar{\theta} - (h - \frac{x}{2})}{\bar{\theta}}$.

In addition, let the newspaper engage in perfect price discrimination on the advertisers' side, i.e., let the newspaper choose advertisement price nt_j for advertiser j .

Advertiser j has outside option $\alpha v_{0,j}$, where $v_{0,j} \sim U [0, \bar{V}]$, and thus places an ad if and only if:

$$nN^R - nt_j \geq \alpha V_{0,j}. \quad (15)$$

Again, $v_{0,j}$ captures advertiser j 's payoff on alternative platforms, and α captures the supply of these alternative platforms. The advertisement revenue is thus equal to:

$$\Pi^A = n \int_0^{\bar{V}} \max [N^R - \alpha V_{0,j}, 0] dj$$

$$= n \frac{(N^r)^2}{2\bar{V}\alpha}$$

The newspaper therefore chooses p and h to maximize expected payoff:

$$\Pi = \Pi^S + \Pi^K + \Pi^A = ns \left(\frac{\bar{\theta} - (2h - p)}{\bar{\theta}} \right) + np \left(\frac{h - p + \frac{x}{2}}{\bar{\theta}} \right) + n \frac{(N^R)^2}{2\bar{V}\alpha}. \quad (16)$$

The following proposition captures the newspaper's optimal prices.

Proposition 2 *The optimal pricing policy of the newspaper is such that:*

$$t_j^* = \max [N^R - \alpha V_{0,j}, 0] \quad (17)$$

$$h^* = \frac{1}{2} \frac{(\bar{\theta}\alpha\bar{V} - 1)(2\bar{\theta} + x)}{2\bar{\theta}\alpha\bar{V} - 1}, \quad (18)$$

$$p^* = h^* + \frac{x}{4} \quad (19)$$

Proof. Differentiating with respect to h and p , and solving the system of two equations, yields the formulas stated in the proposition. ■

Not surprisingly, we find that the price charged to occasional readers is higher than that charged to subscribers. Interestingly, in this simplified model, we find that it is always optimal for the newspaper to engage in second-degree price discrimination on the readers' side so long as $x > 0$, that is, so long as there is some uncertainty over the taste for reading that can be exploited. Indeed, recall that it is without loss of generality for the newspaper to set prices such that $p \geq h$ since the outcome without subscription can always be replicated by setting $p = h$.

Corollary 1 *An increase in the common component of the advertisers' outside options α leads to an increase in the prices on the readers' side.*

Proof Follows from differentiating the formulas for the prices stated in Proposition 2 with respect to α . ■

Intuition. The intuition for this result is as follows. The presence of advertisers whose payoff increases with the average number of readers leads to the newspaper charging lower prices to readers that it would choose absent advertisers. If the benefit of doing so is high enough, readers could even be charged prices below marginal cost (they would then be effectively subsidized). The benefit of doing so to the newspapers naturally comes from the fact that the created surplus can be then extracted through the price charged to advertisers. Now, if the advertisers' outside option increases so that lower prices must be charged, it becomes less interesting for the newspaper to cater to their taste, and we thus observe a movement in the prices charged to the readers towards what they would be absent advertising: higher.

3 Empirical Analysis

The model we built in the previous section provided us with a general framework with which to think about the determinants of pricing policies by newspapers, including the extent of price discrimination. In this section, we study empirically how price discrimination varies with advertisement revenues.

The empirical strategy we follow is in the spirit of an event study. We exploit the introduction of advertising on French Television in October 1968 as an exogenous negative shock on the advertising side of newspapers. To the best of our knowledge, we are the first to use this “quasi-natural” experiment. Moreover, for the purpose of this study, we build a new dataset from archive data on newspapers’ price, revenues, expenditures and circulation.

Our identifying assumption is that the negative shock on advertisement revenues has affected national daily newspapers, but not local daily newspapers – national newspaper ads are national commercial ads while local newspaper ads are local ads. We thus use national newspapers as our “treated group”, and local newspapers as our “control group”. Our results are robust to a range of alternative specifications and controls. In particular, we allow for flexible time-varying effects of the negative shock on advertisement revenues (Laporte and Windmeijer, 2005). Before entering into further details regarding our estimation strategy, we present the historical background, our data sources and descriptive statistics.

3.1 Historical Background

3.1.1 The French Television Industry in the 60’s

French Television is state-owned from 1945 to 1981. There is only one channel until 1963. A second channel is introduced in 1964 and a third one in 1972. TV penetration is increasing at the time, as shown in Figure 1.

[FIGURE 1 HERE]

Channels are financed mostly through a fee (*redevance*) until 1968. By law, advertisement cannot be broadcasted on television. Due to the transition to colored television, and the increased number of programs, the public agency in charge of broadcasting (ORTF) finds it increasingly difficult to finance itself exclusively through the free. In October 1967, despite strong resistances from the newspaper industry, the French government decides to introduce advertisement on TV Channel 1. The first advertisement is broadcasted one year later, in October 1968.

The time devoted to advertisement is of 2 minutes per day in 1968, 4 in 1969, 8 in 1970 (i.e. 2,720 minutes per year), and more than 12 in 1971. Moreover, advertisement revenues for the ORTF represent 120 millions francs in 1969, 430 in 1970 and 470 in 1971 (i.e. 25% of its total revenues). The introduction of advertisement on TV in 1968 can thus be considered as a significant negative shock on the advertisers’ side of the newspaper industry.

3.1.2 The French Daily Newspaper Industry in the 60’s

The French daily newspaper industry is divided into two sub-industries: the *local* daily newspaper industry and the *national* daily newspaper industry. During our period of interest (1960-1974), there are around 100 (national and local) newspapers – with a small decrease in this number.

There are 16 national newspapers at the beginning of the period and 13 at the end.³ Out of these 13 national daily newspapers, 10 are general information newspapers, while the others are either sport or financial newspapers. Since local newspapers are general information newspapers, we only consider national general information newspapers for the sake of the comparison.⁴ These 10 newspapers represent 95% of the total national daily newspaper circulation. The total national newspaper circulation is stable during this time, with around 4.2 million copies sold every day.

The number of local newspapers during the same period varies around 90, with a total circulation amounting to around 7.8 million copies (see Cagé (2013) for more details on the historical evolution of the French local daily newspapers industry). The market for local newspapers in France is a “department”, which is the equivalent of a US county. By a small abuse of language, and for the sake of clarity, we use in this article the term counties when referring to French departments.⁵

3.2 Data Sources and Descriptive Statistics

3.2.1 Newspaper Data

We collect an annual balanced panel dataset on local and national newspapers in France between 1960 and 1974 in order to study the impact of the introduction of advertisement on television in 1968. The data is paper data that we digitize and merge from the French Ministry of Information’s non-publicly available records in the National archives. Newspapers were asked by the Ministry of Information to report annually on revenues and expenses. We collect data by having direct access to their responses to these queries.

Local and National Newspapers. Our dataset includes data for 61 of the local newspapers, i.e. more than three quarters of the local daily newspapers industry in 1971. These newspapers are the only ones for which the data is available in the archives. They represent on average more than 87% of the total local daily newspaper circulation. Our sample of national newspapers include all the 10 general information national newspapers circulating between 1960 and 1974.

Price, Cost and Revenue Data. For the 71 newspapers described above we collect data on prices with information on (i) unit price; (ii) subscription price; and (iii) the number of issues per year. This allows us to compute a measure of price discrimination. We also have data on revenues: (i) revenues from sales and (ii) revenues from advertisement; and on costs: (i) paper expenses, (ii) print expenses and (iii) others expenses, as well as (iv) the quantity of paper used. Finally, we have data on circulation with (i) the share of unit buyers and (ii) the share of subscribers. Table 1 presents some descriptive statistics for this costs and revenues data.

[TABLE 1 HERE]

³Just to give a quick overview, one newspaper - *Liberation* - exits the industry in 1964, an another one - *Paris Presse* - exits in 1970. One financial newspaper also exits before the end of the period

⁴We drop sport newspapers (e.g. *L'Equipe*) as well as financial newspapers (e.g. *Les Echos*)

⁵There are 101 French counties. The median land area of a county is 2,303 sq mi, i.e. 3.5 times the median land area of an US county.

3.3 Estimation Strategy

We use our panel data to compute differences-in-differences (DD) estimates of the effect of the introduction of advertisement on television. The negative shock on newspaper advertisement revenues following this introduction (our treatment) only affects national newspapers (treated group) but not local newspapers (control group). We thus compare the pre-1968-to-post-1968 change in prices of national daily newspapers to the change in prices of local daily newspapers over the same period.

Let $D_{\text{national news}}$ be an indicator variable for national newspapers and D_{after} be a time dummy that switches on for observations post 1968 (i.e., after the introduction of advertisement on TV). Our analysis is based on the following regression equation:

$$\begin{aligned} \log \text{ price ratio}_{n,t} = & \alpha + \beta_1 D_{\text{after}} + \beta_2 D_{\text{national news}} + \beta_3 (D_{\text{after}} * D_{\text{national news}}) \\ & + \alpha X_{n,t} + \lambda_n + \gamma_t + \epsilon_{n,t} \end{aligned} \quad (20)$$

where n indexes newspapers and t indexes years ($t = 1960, \dots, 1974$). λ_n is a newspaper fixed effect, γ_t is a year fixed effect, and $\epsilon_{n,t}$ is a newspaper-year shock. $X_{n,t}$ is a vector of newspaper-level controls. It includes circulation and operating costs. Standard errors are clustered at the newspaper level.

The dependent variable, $\log \text{ price ratio}_{n,t}$, is the log of the price ratio of newspaper n in year t defined as the subscription price per issue divided by the unit price. The price ratio is our measure of price discrimination (Clerides, 2004). Due to the inclusion of newspapers and year fixed effects, the coefficient β_3 – our coefficient of interest – measures the annual price ratio effect for national newspapers of the introduction of advertisement on TV compared to the general evolution of the price ratio for local newspapers.

The key identifying assumption here is that price trends would be the same for both categories of newspapers (local and national) in the absence of treatment. The treatment induces a deviation from this common trend. Figure 2 provides strong visual evidence of treatment and control newspapers with a common underlying trend, and a treatment effect that induces a sharp deviation from this trend. However, as an alternative check on the DD identification strategy, we add an industry-specific time trend to the list of controls. In other words we estimate:

$$\begin{aligned} \log \text{ price}_{n,t} = & \alpha + \beta_1 D_{\text{after}} + \beta_2 D_{\text{national news}} + \beta_3 (D_{\text{after}} * D_{\text{national news}}) \\ & + \mu_{1\text{national}} t + \alpha X_{n,t} + \lambda_n + \gamma_t + \epsilon_{n,t} \end{aligned} \quad (21)$$

where $\mu_{1\text{national}}$ is a national newspapers industry-specific trend coefficient multiplying the time trend variable t . The introduction of these industry-specific time trends allows treatment and control newspapers to follow different trends in a limited but potentially revealing way.

[FIGURE 2 HERE]

Finally, the unbiasedness of the DD estimates requires the strict exogeneity of the introduction of advertisement on TV. As we underline above, French Television is state-owned from 1945 to 1981. There is thus no interaction between TV owners and newspaper owners, be they national or local. The introduction of advertisement on TV was decided unilaterally by the French government to answer the concerns of the ORTF. It is exogeneous to the newspaper industry.

3.4 Results

3.4.1 Benchmark Estimates

Table 2 reports estimates of equations (20) and (21). It appears clearly in column 1 (baseline estimation without controls and time trends) that there is a statistically significant decrease in the price ratio of national newspapers compared to local newspapers following the introduction of advertisement on TV. Moreover, this negative effect is robust to controlling for a national newspapers industry-specific time trend which is reassuring as to the validity of our DD identification strategy (column 2). This result is robust to the introduction of newspaper-level controls (column 3).

[TABLE 2 HERE]

3.4.2 Timing of the Effect

This before-after event study approach enables us to control for time-invariant newspaper-specific effects and general time trends. As an additional robustness check, we allow for flexible time-varying effects of the negative shock on advertisement revenues (Laporte and Windmeijer, 2005). To quantify the dynamics effects of the event and control for lags and leads, we define (“pulse”) variables for two, non-overlapping, three-years spaced periods around the event and a dummy variable isolating the long-run effect of the shock (see e.g. (Papaioannou and Siourounis, 2008)).

Our specification is:

$$\begin{aligned} \log \text{ price ratio}_{n,t} = & \alpha + \delta_1 d_{n,t}^1 + \delta_2 d_{n,t}^2 + \delta_3 d_{n,t}^3 \\ & + \alpha X_{n,t} + \lambda_n + \gamma_t + \epsilon_{n,t} \end{aligned} \tag{22}$$

where $d_{n,t}^1 = 1$ in 1966, 1967 and 1968 for national newspapers (pre introduction of advertisement on TV); $d_{n,t}^2 = 1$ in 1969, 1970 and 1971 for national newspapers (at the time of the introduction and in the following years); and $d_{n,t}^3 = 1$ in 1972 and all subsequent post-introduction years (until 1974). Each indicator variable equals zero in all other years than those specified and for local newspapers. Thus the base period is the years before 1966.

Table 3 presents the results. In column 1 we report the results without controls, and in column 2 we introduce newspaper-level controls. We find no statistically significant effect (with a point estimate close to zero) for the pulse variable $d_{n,t}^1 = 1$. This is reassuring as to the validity of our DD strategy. Moreover, as expected given the results of Table 2, we obtain a negative and statistically significant at the 1% level δ_2 : there is a statistically significant decrease in the price ratio – i.e. in the extent of price discrimination – of national newspapers compared to local newspapers following the introduction of advertisement on TV. This effect is long lasting: the δ_3 is statistically significant and the point estimates is higher than for the short-run effect (column 1) and increases when we introduce controls (column 2).

[TABLE 3 HERE]

4 Conclusion

We have built a model in which a profit-maximizing newspaper must attract both readers and advertisers. Particular attention has been paid to the incentives the newspaper has to engage in second-degree price discrimination, and how these interact with the advertisers’ side

of the industry. In our model, there is scope for second degree price-discrimination because of the uncertainty surrounding the future taste for reading. The newspaper sets its prices such that readers with a high average taste for reading subscribe at a relative low unit cost, while readers with an intermediate average taste for reading only buy occasionally, but at a high price. One general tendency that emerges is that, as long as advertisers prefer large readerships to smaller one, prices charged to readers tend to be lower than absent the advertisers' side of the industry. Following a general increase in the outside option of newspapers we therefore find that prices tend to go up. As for the extent of price discrimination, the interaction with the advertisers' side is more subtle since then elasticities, group sizes, as well as the average taste of marginal advertisers (those indifferent between placing an ad or not) are all relevant. According to the empirical evidence we obtain using French daily newspapers between 1960 and 1974, price discrimination decreases with advertisement revenues.

Our findings have implications for the 21st century newspaper industry. As advertisement revenues continue decreasing, we should increasingly observe a tendency for newspapers to move towards a subscriber-based readership. This suggests that, if governments decide to intervene to limit the decline of this industry, subsidizing delivery costs could prove effective. This will be the object of future research.

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Table 1: Summary Statistics

	mean/sd
Prices	
Unit Price	0.46 (0.12)
Subscription Price Per Issue	0.39 (0.10)
Price Ratio	0.86 (0.07)
Revenues and Costs	
Revenues from Ad	13.37 (21.57)
Revenues from Sales	17.32 (22.53)
Total Expenditures	26.52 (36.66)
Profit	0.96 (6.83)
Circulation	
Total Circulation	155,166 (214,646)
Share Unit Buyers (%)	61 (20)
Share Subscribers (%)	25 (22)
Observations	973

Notes: The table gives summary statistics. Numbers in parentheses are standard deviations and the others are averages. Time period is 1960-1974. Variables are values for newspapers. Unit price and subscription price per issue are in (constant 2009) euros. Revenues and costs are in (constant 2009) million euros

Table 2: The Effect of the Decrease in Advertisement Revenues on the Price Ratio: Baseline Estimation

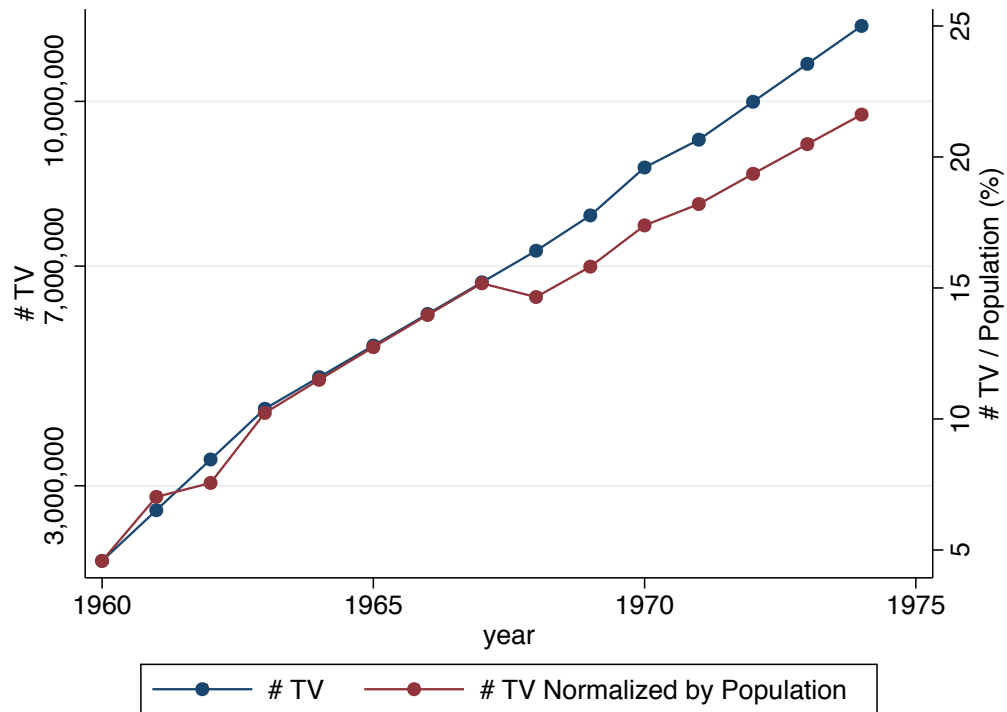
	Price Ratio		
	(1)	(2)	(3)
National x Post-1968	-0.12*** (0.02)	-0.07*** (0.02)	-0.07*** (0.02)
Year FE	Yes	Yes	Yes
News FE	Yes	Yes	Yes
Industry-Specific Trend	No	Yes	Yes
News Controls	No	No	Yes
R-sq	0.14	0.14	0.20
Observations	968	968	955
Clusters (news)	71	71	71

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered by newspaper. Time period is 1960-74. Models are estimated using OLS estimations. Newspaper controls are newspaper circulation and expenditures. Variables are described in more details in the text.

Table 3: The Effect of the Decrease in Advertisement Revenues on the Price Ratio: Timing of the Effect

	Price Ratio	
	(1)	(2)
Pre Introduction of Advertisement on TV (1966-1968)	-0.02 (0.02)	-0.02 (0.02)
Short-Run Introduction of Advertisement on TV (1969-1971)	-0.12*** (0.01)	-0.12*** (0.02)
Long-Run Introduction of Advertisement on TV (1972, onwards)	-0.13*** (0.02)	-0.15*** (0.02)
Year FE	Yes	Yes
News FE	Yes	Yes
News Controls	No	Yes
R-sq	0.14	0.19
Observations	968	955
Clusters (news)	71	71

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered by newspaper. Time period is 1960-74. Models are estimated using OLS estimations. Newspaper controls are newspaper circulation and expenditures. Variables are described in more details in the text.



Notes: This Figure represents the evolution of TV penetration in France between 1960-1974. Data on TV equipment is from studies conducted for the advertising market (PROSCOP) and data on population is from the French national institute for statistics (INSEE).

Figure 1: TV Penetration in France, 1960-1974

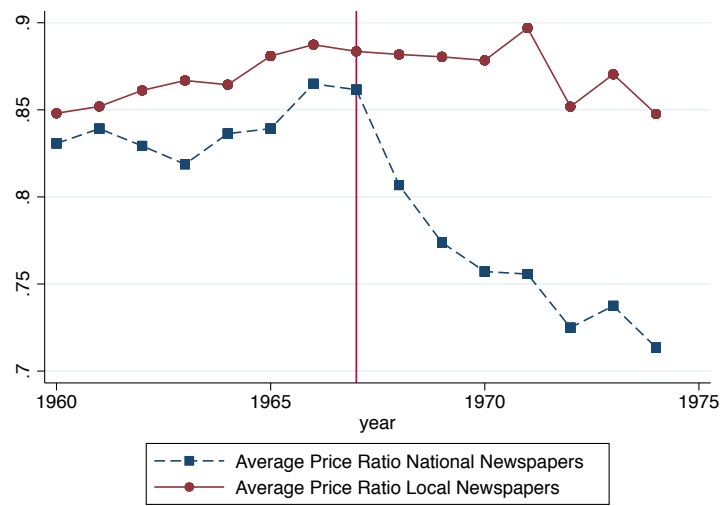


Figure 2: Descriptive Evidence: Changes in Price Discrimination.