

Online Appendix to the Paper:
Newspapers in Times of Low Advertising Revenues

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A Theory

We modify the benchmark model in two ways. In Section A.1, we treat journalistic-intensive content as a “vertical” attribute. In Section A.3, we extend A.1’s framework to allow the newspaper to sell both subscriptions and individual issues to readers.

A.1 A simple model of quality provision

Suppose a monopoly newspaper, a mass 1 of readers, and a mass 1 of advertisers exist. The advertisers’ willingness to pay for an advertisement in the newspaper increases with the latter’s readership. For simplicity, we assume readers are indifferent regarding the quantity of advertising in the newspaper. The newspaper chooses the price p^R charged to readers and the price p^A charged to advertisers, as well as the *quality* q of the content it produces to attract readers.¹

This model is related to previous work that investigates the relationship between media bias and advertising revenues (e.g. Gentzkow et al., 2006; Ellman and Germano, 2009; Petrova, 2012). In these models, readers dislike media bias and a reduction in bias can thus be interpreted as an increase in quality. Unlike these models, however, quality in our setting is costly to produce and only indirectly enters advertisers’ payoffs.

A.1.1 Set-up

Readers Suppose the payoff to reader i from purchasing the newspaper is $U_i = \gamma q + \hat{\epsilon} - p^R$, where $\gamma \geq 0$ captures readers’ sensitivity to quality, and where $\hat{\epsilon} \geq 0$ captures readers’ quality-independent taste for the newspaper.² For simplicity, we assume readers are indifferent about the newspaper’s quantity of advertisements. Finally, readers are heterogeneous in their outside option: each reader i has an outside option u_i uniformly and independently distributed on $[0, 1]$.

Advertisers Suppose the payoff to advertiser j from purchasing an ad is $V_j = \alpha d^R - p^A$, where d^R represents the number of readers who make a purchase (see below). The parameter $\alpha \geq 0$ captures the advertisers’ willingness to pay for the readers’ attention, and allows us to carry out comparative statics related to the newspaper’s reliance on advertising revenues. For instance, a decrease in α can represent the arrival of a new (or the improvement of an existing) advertising platform (e.g., a social media site). Finally, advertisers are heterogeneous

¹Although our leading application is the newspaper industry, our model applies more generally to any two-sided market in which quality provision matters to attract consumers on one side of the market.

²One can interpret $\hat{\epsilon}$ as the expected value of a random shock that affects readers’ willingness to pay for the newspaper (common to all readers and unknown prior to the purchase). In section A.3, the newspaper exploits such uncertainty to price discriminate between readers.

in their outside option: each advertiser j has an outside option \underline{v}_j uniformly and independently distributed on $[0, 1]$.

Newspaper The newspaper incurs a fixed cost $\frac{1}{2}q^2$ to produce content of quality q . Holding prices constant, all readers are better off when q increases (i.e., q is a “vertical” attribute, e.g., better printing paper, better coverage of news, etc.).³ The newspaper also incurs a (zero) marginal cost $c^R = 0$ to serve readers and a (zero) marginal cost $c^A = 0$ to serve advertisers. The newspaper chooses the reader price p^R , the advertising price p^A , and the quality of its content q to maximize its expected profit:

$$\Pi(p^R, p^A, q) = p^R d^R(p^R, q) + p^A d^A(p^R, p^A, q) - \frac{1}{2}q^2, \quad (1)$$

where $d^R(p^R, q)$ and $d^A(p^R, p^A, q)$ represent the demand from readers and the demand from advertisers (computed below), respectively.

Assumptions In Section A.2, we show the newspaper’s objective function is strictly concave in (p^R, p^A, q) if and only if $\alpha < 2$, $\gamma < \sqrt{2}$, and $4 - \alpha^2 - 2\gamma^2 > 0$. Moreover, to ensure neither side of the market is covered, we impose the stricter condition $2\hat{\epsilon} < 4 - \alpha^2 - 2\gamma^2$.

A.1.2 The newspaper’s problem

We begin by computing the demand functions. Reader i purchases the newspaper if and only if $U_i = \gamma q + \hat{\epsilon} - p^R \geq \underline{u}_i$. It follows the demand from readers is $d^R(p^R, q) = \gamma q + \hat{\epsilon} - p^R$. Similarly, advertiser j places an ad in the newspaper if and only if $V_j = \alpha(\gamma q + \hat{\epsilon} - p^R) - p^A \geq \underline{v}_j$. It follows the demand from advertisers is $d^A(p^R, p^A, q) = \alpha(\gamma q + \hat{\epsilon} - p^R) - p^A$. As a result, the newspaper chooses p^R , p^A , and q to maximize its expected profits:

$$\Pi(p^R, p^A, q) = p^R d^R(p^R, q) + p^A d^A(p^R, p^A, q) - \frac{1}{2}q^2, \quad (2)$$

$$= p^R(\gamma q + \hat{\epsilon} - p^R) + p^A(\alpha(\gamma q + \hat{\epsilon} - p^R) - p^A) - \frac{1}{2}q^2. \quad (3)$$

The associated system of first-order conditions is given by

³In other words, q does not capture the newspaper’s positioning or ideology/bias for which readers would hold heterogeneous tastes.

$$\frac{\partial}{\partial p^R} \Pi(p^R, p^A, q) = 0 \iff 2p^R = \gamma q + \hat{\epsilon} - p^A \alpha, \quad (4)$$

$$\frac{\partial}{\partial p^A} \Pi(p^R, p^A, q) = 0 \iff 2p^A = \alpha(\gamma q + \hat{\epsilon} - p^R), \quad (5)$$

$$\frac{\partial}{\partial q} \Pi(p^R, p^A, q) = 0 \iff q = \gamma(p^R + \alpha p^A). \quad (6)$$

Solving the system of equations (4), (5), and (6) for p^R , p^A , and q yields the solution to the newspaper's problem, which we state in the next proposition together with the main comparative statics of interest.

Proposition 1 *It is optimal for the newspaper to set*

$$p^R = \frac{(2 - \alpha^2) \hat{\epsilon}}{4 - \alpha^2 - 2\gamma^2} \quad p^A = \frac{\alpha \hat{\epsilon}}{4 - \alpha^2 - 2\gamma^2} \quad q = \frac{2\hat{\epsilon}\gamma}{4 - \alpha^2 - 2\gamma^2}.$$

A decrease in α —that is, a decrease in the advertisers' willingness to pay for the newspapers' readers—(i) always lowers the quality q of content, (ii) always lowers the price p^A charged to advertisers, and (iii) lowers the price p^R charged to readers if and only if readers are sufficiently sensitive to quality (i.e., $\gamma > 1$).

Proof. See Appendix Section A.2. ■

A decrease in the advertisers' willingness to pay α lowers the price p^A the newspaper charges advertisers. A decrease in α also induces the newspaper to *lower the quality of its content*. Quality serves to attract readers, and the newspaper has lower incentives to attract readers when advertising revenues decline. Further, a decrease in α may either increase or decrease the price charged to readers depending on readers' sensitivity to quality. On the one hand, holding quality constant, a decline in the advertisers' willingness to pay induces the newspaper to increase the price it charges readers. This result is the standard “waterbed effect” whereby the newspaper has lower incentives to attract readers through low prices when advertising revenues decline.⁴ On the other hand, the decline in quality that follows the drop in advertising revenues reduces the demand from readers in a way that pushes p^R downward. Intuitively, the latter effect dominates—and p^R decreases—if the demand from readers decreases sharply enough, that is, if readers are sufficiently sensitive to quality (i.e., $\gamma > 1$).

⁴More generally, the newspaper's incentives to cater to the marginal advertisers' preferences decrease when their willingness to pay declines. In our model, the assumption whereby advertisers care exclusively about the number of readers straightforwardly implies the newspaper is better off reducing its readership (through lower quality and/or higher prices).

A.2 Proof of Proposition 1

We first derive the conditions stated in the main body that ensure $0 \leq d^R(p^R, q) \leq 1$ and $0 \leq d^A(p^R, p^A, q) \leq 1$. Substituting the solution stated in Proposition 1 into $d^R(p^R, q)$ yields

$$d^R(p^R, q) = \gamma q + \hat{\epsilon} - p^R = \frac{2\hat{\epsilon}}{4 - \alpha^2 - 2\gamma^2}.$$

It follows $d^R(p^R, q) \leq 1$ if and only if $2\hat{\epsilon} \leq 4 - \alpha^2 - 2\gamma^2$. Moreover, if $2\hat{\epsilon} \leq 4 - \alpha^2 - 2\gamma^2$, $d^R(p^R, q) > 0$ necessarily.

Substituting the solution stated in Proposition 1 into $d^A(p^R, p^A, q)$ yields

$$d^A(p^R, p^A, q) = \frac{\alpha\hat{\epsilon}}{4 - \alpha^2 - 2\gamma^2}.$$

It follows $d^A(p^R, p^A, q) \leq 1$ if and only if $\alpha\hat{\epsilon} \leq 4 - \alpha^2 - 2\gamma^2$. Moreover, if $\alpha\hat{\epsilon} \leq 4 - \alpha^2 - 2\gamma^2$, $d^A(p^R, p^A, q) > 0$ necessarily.

We conclude the proof by verifying that the objective function (3) is strictly concave in (p^R, p^A, q) . The Hessian matrix H associated to (3) is given by

$$\begin{pmatrix} \frac{\partial^2 \Pi}{\partial p^R \partial p^R} & \frac{\partial^2 \Pi}{\partial p^R \partial p^A} & \frac{\partial^2 \Pi}{\partial p^R \partial q} \\ \frac{\partial^2 \Pi}{\partial p^A \partial p^R} & \frac{\partial^2 \Pi}{\partial p^A \partial p^A} & \frac{\partial^2 \Pi}{\partial p^A \partial q} \\ \frac{\partial^2 \Pi}{\partial q \partial p^R} & \frac{\partial^2 \Pi}{\partial q \partial p^A} & \frac{\partial^2 \Pi}{\partial q \partial q} \end{pmatrix} = \begin{pmatrix} -2 & -\alpha & \gamma \\ -\alpha & -2 & \alpha\gamma \\ \gamma & \alpha\gamma & -1 \end{pmatrix}$$

We verify H is negative definite. Because H is real and symmetric, it has three real eigenvalues. To compute these eigenvalues, we solve for the polynomial $P(\lambda)$ representing the determinant of

$$\begin{vmatrix} -2 - \lambda & -\alpha & \gamma \\ -\alpha & -2 - \lambda & \alpha\gamma \\ \gamma & \alpha\gamma & -1 - \lambda \end{vmatrix}$$

We obtain $P(\lambda) = -\lambda^3 - 5\lambda^2 + (\alpha^2\gamma^2 + \alpha^2 + \gamma^2 - 8)\lambda + (\alpha^2 + 2\gamma^2 - 4)$. Let λ_1 , λ_2 , and λ_3 denote the three real solutions of $P(\lambda) = 0$. By definition, these solutions are the three eigenvalues of H . If all three eigenvalues of H are positive, all coefficients in $P(\lambda)$ must either be positive or negative. One obtains that all coefficients are non-positive if and only if $\alpha^2\gamma^2 + \alpha^2 + \gamma^2 < 8$ and $\alpha^2 + 2\gamma^2 < 4$. Pairs of $\alpha \geq 0$ and $\gamma \geq 0$ that satisfy both inequalities exist if and only if $\alpha < 2$ and $\gamma < \sqrt{2}$. Under these restrictions, inequality $\alpha^2 + 2\gamma^2 < 4$ implies inequality $\alpha^2\gamma^2 + \alpha^2 + \gamma^2 < 8$. To conclude, therefore, expression (3) is strictly concave if and only if $\alpha < 2$, $\gamma < \sqrt{2}$, and $\alpha^2 + 2\gamma^2 < 4$.

A.3 Price Discrimination

Our paper also contributes to a small but growing literature on price discrimination in two-sided markets. For instance, Liu and Serfes (2013) analyze first-degree price discrimination in a duopoly setting, and Carroni (2015) provides a model of past-behavior-based price discrimination. Instead, we extend Glazer and Hassin (1982)'s model of subscriptions as a means to engage in second-degree price discrimination to two-sided markets (with, moreover, endogenous quality provision).⁵ Our paper is thus also related to the growing literature that examines empirically the determinants of price discrimination. A 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 competition on price discrimination using data from the US airline industry, and Seim and Viard (2011), who study nonlinear pricing in cellular telecommunication markets. With the exception of Gil and Riera-Crichton (2011), who empirically test the relationship between price discrimination and competition in the Spanish local television industry, all these articles study one-sided markets.⁶

We modify the model outlined in Section A.1 to allow the newspaper to sell subscriptions as well as individual issues. This generalization allows us to formulate additional predictions regarding the relationship between newspapers' reliance on advertising revenues and their incentives to charge subscribers and occasional readers different prices. The main modifications are as follows. A newspaper and a mass 1 of readers exist. The game is finitely repeated in discrete time $t = 0, \dots, n$. The newspaper publishes an issue in every period $t \geq 1$. Moreover, in period 0, the newspaper chooses the subscription and unit prices it charges readers, as well as the quality q of its content. Readers are (i) uncertain about their willingness to pay for future issues and (ii) heterogeneous in their expected willingness to pay. In period 0, each reader can either purchase a subscription at price np^S , which provides her with all n issues, or choose to make n separate purchasing decisions. The price of each individual issue is p^O . As we show below, the newspaper exploits readers' uncertainty and heterogeneity by selling subscriptions at an average price lower than the price it charges occasional buyers; that is, the newspaper price discriminates among readers. Finally, for simplicity, we no longer let the newspaper choose the price p^A of advertising. Instead, we assume a constant marginal

⁵On the economics of subscriptions, see also Gabszewicz and Sonnac (1997); Morton and Oster (2003); Resende and Ferioli (2014). Further, the logic behind providing subscribers with several issues of the newspaper is related to the economics of bundling, (see, e.g., Adams and Yellen, 1976).

⁶Using evidence from Swedish newspapers, Asplund et al. (2008) show that more competitive markets have a higher incidence on third-degree price discrimination. However, they do not take into account the advertising side of the industry.

advertising benefit of each additional reader.⁷

In what follows, we focus on the case of empirical interest in which the newspaper sells both subscriptions and individual issues (as opposed to subscriptions only or individual issues only). Below, we provide sufficient conditions which ensure this policy is profit-maximizing for the newspaper. For the sake of brevity, we do not analyze the case in which it is profit-maximizing to sell individual issues only, nor the case in which it is profit-maximizing to sell subscriptions only.

A.3.1 Set-up

Readers The gross payoff to reader i from purchasing the newspaper in period t is

$$U_{i,t} = \gamma q + \epsilon_t, \tag{7}$$

where ϵ_t represents a period-specific and quality-independent shock common to all readers. We suppose $\epsilon_t \in \{\underline{\epsilon}, \bar{\epsilon}\}$, with $\Pr(\epsilon_t = \underline{\epsilon}) = \frac{1}{2} \forall t$. We denote by $\hat{\epsilon}$ the expected value of ϵ_t , where $\hat{\epsilon} = \frac{1}{2}\underline{\epsilon} + \frac{1}{2}\bar{\epsilon}$, and by $\Delta\epsilon = \bar{\epsilon} - \underline{\epsilon}$ the spread of uncertainty. As before, $\gamma \geq 0$ captures readers' sensitivity to quality and, moreover, each reader i has a time-invariant per-period outside option \underline{u}_i uniformly and independently distributed on $[0, 1]$. We refer to $\gamma q + \epsilon_t - \underline{u}_i$ as reader i 's *realized* willingness to pay for period t 's issue, and $\gamma q + \hat{\epsilon} - \underline{u}_i$ as reader i 's *expected* willingness to pay for a single issue.

Readers decide whether to subscribe (at time 0) before knowing their willingness to pay for any single issue. The expected payoff to reader i from subscribing is equal to

$$\mathbb{E}[U_i] = \begin{cases} n(\gamma q + \hat{\epsilon} - p^S) & \text{if } \underline{u}_i \leq \gamma q + \underline{\epsilon}, \\ \frac{n}{2}(\gamma q + \bar{\epsilon}) + \frac{n}{2}\underline{u}_i - np^S & \text{if } \gamma q + \underline{\epsilon} < \underline{u}_i \leq \gamma q + \bar{\epsilon}, \\ n\underline{u}_i - np^S & \text{if } \gamma q + \bar{\epsilon} < \underline{u}_i. \end{cases} \tag{8}$$

Expression (8) takes into account the expected frequency with which reader i reads the newspaper when subscribing (as a function of the time-invariant per-period outside option \underline{u}_i).⁸

Readers who choose not to subscribe make n separate purchasing decisions. In particular, $\forall t \geq 1$, readers observe ϵ_t *before* making their purchasing decision. As a result, the expected

⁷Micro-founding the advertising demand as in Section A.1 would give the newspaper four choice variables, thereby significantly complicating the analysis. Solving the associated system of first-order conditions suggests our results hold in this more general model. However, verifying the global concavity of the newspaper's profit function becomes rather cumbersome. Finally, we choose to model advertising revenues in a reduced-form because we believe our most interesting empirical findings concern the reader side of the market. For a survey of papers on media markets in which advertising revenues are modeled in a similar fashion, see Anderson and Jullien (2015).

⁸The subscription price p^S is irrelevant to a subscriber's decision regarding whether to read a given issue, because it is sunk by the time the decision is made.

payoff to reader i from not subscribing to the newspaper is equal to

$$\mathbb{E}[U_i] = \begin{cases} n(\gamma q + \hat{\epsilon} - p^O) & \text{if } \underline{u}_i \leq \gamma q + \underline{\epsilon} - p^O, \\ \frac{n}{2}(\gamma q + \bar{\epsilon} - p^O) + \frac{n}{2}\underline{u}_i & \text{if } \gamma q + \underline{\epsilon} - p^O < \underline{u}_i \leq \gamma q + \bar{\epsilon} - p^O, \\ n\underline{u}_i & \text{if } \gamma q + \bar{\epsilon} - p^O < \underline{u}_i. \end{cases} \quad (9)$$

Readers with a high willingness to pay are willing to purchase every issue at price p^O . By contrast, readers with an intermediate willingness to pay purchase *on average* half the issues. In particular, they make a purchase only when $\epsilon = \bar{\epsilon}$. Finally, readers with a low willingness to pay never make a purchase. We refer to the non-subscribers who make a purchase with positive probability as the “occasional buyers.”

Recall our focus on the case in which the newspaper sells *both* subscriptions and individual issues. By comparing (8) and (9), we note the newspaper must necessarily set $\frac{1}{2}p^O \leq p^S \leq p^O$ to achieve this outcome. When $p^S > p^O$, no reader chooses to subscribe because the subscription price np^S is higher than the total price np^O paid when buying all n issues separately. Therefore, $p^S \leq p^O$ necessarily, and all the readers who would be willing to purchase all n issues separately absent subscriptions are better off subscribing. It follows the only readers left to become occasional buyers are a subset of those willing to purchase only half the individual issues on average. To prevent these potential occasional buyers from subscribing, the newspaper must set the average subscription price at least as high as half the unit price, that is, $\frac{1}{2}p^O \leq p^S$ necessarily. If the newspaper were to set $\frac{1}{2}p^O > p^S$, all occasional readers would be better off subscribing because the subscription price np^S would be lower than the expected newsstand expense $\frac{n}{2}p^O$.

The condition $\frac{1}{2}p^O \leq p^S \leq p^O$ thus also determines the expected frequency with which subscribers and occasional buyers read. Specifically, readers who subscribe read all n issues (for otherwise they would be better off not subscribing) and readers who do not subscribe (i.e., occasional buyers) read only half the issues on average (for otherwise they would be better off subscribing). It therefore follows from (8) that $p^S \leq \gamma q + \hat{\epsilon}$ must necessarily hold if some readers are to become subscribers, and from (9) that $p^O \leq \gamma q + \bar{\epsilon}$ must necessarily hold if some readers are to become occasional buyers (i.e., if some readers are to make a purchase when $\epsilon = \bar{\epsilon}$). To summarize, the newspaper must necessarily set $\frac{1}{2}p^O \leq p^S \leq \min[p^O, \gamma q + \hat{\epsilon}]$ and $p^O \leq \gamma q + \bar{\epsilon}$ if it wishes to sell both subscriptions and individual issues.

Finally, we note that, because $np^S > \frac{n}{2}p^O$, it is the readers with a relatively high expected willingness to pay (i.e., a relatively low outside option) who become subscribers, and the readers with an intermediate expected willingness to pay (i.e., an intermediate outside option) who become occasional buyers.

Advertising revenues We suppose the newspaper enjoys per-period advertising profits equal to

$$\Pi^A = \alpha \left(b d^R + (1 - b) \hat{d}^R \right), \quad (10)$$

where (i) d^R denotes the total number of subscribers and occasional buyers and (ii) \hat{d}^R denotes the per-period *expected* total number of readers. These two quantities do not coincide, because subscribers and occasional buyers read with different frequencies on average.⁹ This specification assumes advertisers care both about the number of readers who read the newspaper with positive probability—for instance, if they place an ad in more than one issue and/or value a diverse readership¹⁰—and the frequency with which subscribers and occasional buyers read. The parameter $b \in [0, 1]$ represents the weight advertisers attach to d^R . As before, the parameter $\alpha \geq 0$ allows us to do comparative statics related to the newspaper’s reliance on advertising revenues. In particular, a decrease in α can be interpreted as a decrease in the advertisers’ willingness to pay for the newspaper’s readers.

Newspaper We maintain the assumption whereby producing content of quality q costs $\frac{1}{2}q^2$, and again set $c^R = c^A = 0$ for simplicity.

Scope for price discrimination In practice, several factors may induce a newspaper to sell subscriptions in addition to individual issues, and to do so at different average prices; for instance, transaction costs, delivery costs, risk management, advertisers’ preferences for subscribers versus occasional buyers, and so on. Selling subscriptions also allows the newspaper to price discriminate among readers.¹¹ On the one hand, if $p^S \leq p^O$, readers are offered a reduced average price p^S for the purchase of a “bundle” of n issues before knowing their willingness to pay for it. On the other hand, they may delay their purchasing decisions to later (once they have discovered their willingness to pay) but then have to pay a higher price p^O . Whether selling subscriptions at a lower average price than the price of individual issues (as opposed to either selling them at the same price, selling only subscriptions, or selling only individual issues) is profit-maximizing for the newspaper is a priori ambiguous. A drawback of this pricing policy, for instance, is that the consumers with the highest willingness to pay enjoy a lower total price than what they would pay if subscriptions were not available.¹² Ultimately, whether the newspaper is better off selling subscriptions at a lower average price than the price of individual issues depends on the price it is able to charge the occasional buyers, that

⁹Recall subscribers choose to read every issue of the newspaper, whereas occasional buyers read only half the issues on average.

¹⁰A large readership implies a diverse readership if readers’ outside option is correlated with other reader characteristics.

¹¹See Glazer and Hassin (1982) (whose model’s logic we incorporate in our framework) for a detailed discussion on the scope for subscriptions to be used as a means to price discriminate between readers.

¹²Such an outcome is common under second-degree price discrimination.

is, the readers with a *low expected but high realized* willingness to pay. As mentioned earlier, we focus on the case of empirical interest, namely that in which selling both subscriptions and individual issues is profit-maximizing. Below, we prove that imposing $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$ ensures this outcome, and provide the intuition behind these conditions when commenting on Proposition 2.

Because the incentives to price discriminate are independent of the number of issues n , we proceed by setting $n = 1$ to save on notation. The proof covers the more general case with $n \geq 1$.

A.3.2 The newspaper's problem

Above, we identified that it was the readers with a low outside option who choose to subscribe, and those with an intermediate outside option who become occasional buyers. Moreover, we also determined that occasional buyers purchase only half the issues on average: they make a purchase only when $\epsilon = \bar{\epsilon}$. In what follows, we therefore refer to the *marginal subscriber* as the reader indifferent between subscribing and being an occasional buyer, and the *marginal occasional buyer* as the occasional buyer indifferent regarding whether to make a purchase when $\epsilon = \bar{\epsilon}$.

Demand Functions We first compute the demand for subscriptions $d^S(p^S, p^O, q)$. To compute $d^S(p^S, p^O, q)$, it is enough to identify the marginal subscriber and exploit the fact that all readers with an outside option lower than that of the marginal subscriber will choose to subscribe. Because $p^O \geq p^S$, we know the marginal subscriber cannot belong to the (possibly empty) interval $[0, \gamma q + \underline{\epsilon} - p^O]$ of readers who would be willing to purchase every issue at a price p^O absent subscriptions. Also, because $p^S \geq \frac{1}{2}p^O$, we know the marginal subscriber belongs to the interval $[0, \gamma q + \underline{\epsilon}]$ of subscribers who read all n issues. Therefore, the marginal subscriber is necessarily indifferent between subscribing (and reading all n issues) and purchasing on average half the issues. To compute the demand $d^S(p^S, p^O, q)$, we thus equate (8) (for the case in which $\underline{u} \leq \gamma q + \underline{\epsilon}$) to (9) (for the case in which $\underline{u} \in [\gamma q + \underline{\epsilon} - p^O, \gamma q + \bar{\epsilon} - p^O]$), and rearrange for \underline{u} , which yields

$$d^S(p^S, p^O, q) = \max[\gamma q + \underline{\epsilon} + p^O - 2p^S, 0]. \quad (11)$$

Because we focus on the case in which selling subscriptions (in addition to individual issues) is optimal, we anticipate $p^S \leq \frac{1}{2}(\gamma q + \underline{\epsilon} + p^O)$ and thus $d^S(p^S, p^O, q) = \gamma q + \underline{\epsilon} + p^O - 2p^S$. As we would expect, note from (11) that the demand for subscriptions is decreasing in the subscription price p^S , increasing in the quality q , and increasing in the price p^O .

We now compute the demand from occasional buyers $d^O(p^S, p^O, q)$. Because all readers

whose outside option $\underline{u} \leq \gamma q + \underline{\epsilon} + p^O - 2p^S$ prefer to subscribe, where $\gamma q + \underline{\epsilon} + p^O - 2p^S > \gamma q + \underline{\epsilon} - p^O$, the newspaper faces no demand from occasional buyers when $\epsilon_t = \underline{\epsilon}$ (see equation (9)). When $\epsilon_t = \bar{\epsilon}$, all readers whose outside option $\underline{u}_i \in [\gamma q + \underline{\epsilon} + p^O - 2p^S, \gamma q + \bar{\epsilon} - p^O]$ purchase an individual issue. As a result, the demand $d^O(p^S, p^O, q)$, when $\epsilon_t = \bar{\epsilon}$, is equal to

$$d^O(p^S, p^O, q) = \max[\Delta\epsilon + 2p^S - 2p^O, 0]. \quad (12)$$

Because we focus on the case in which selling individual issues (in addition to subscriptions) is optimal, we anticipate $p^O \leq p^S + \frac{\Delta\epsilon}{2}$, and thus $d^O(p^S, p^O, q) = \Delta\epsilon + 2p^S - 2p^O$. Intuitively, $d^O(p^S, p^O, q)$ is decreasing in p^O and increasing in p^S . Further, the demand from occasional readers is increasing in $\Delta\epsilon$ because occasional readers make a purchase only when $\epsilon = \bar{\epsilon}$.¹³ Notice also that $d^O(p^S, p^O, q)$ is independent of quality. On the one hand, an increase in q increases $d^O(p^S, p^O, q)$ because it induces more readers to become occasional buyers (i.e., it induces more readers to make a purchase when $\epsilon_t = \bar{\epsilon}$). On the other hand, an increase in q decreases $d^O(p^S, p^O, q)$ because it induces some occasional buyers to subscribe. Under the uniform distribution assumption, both effects cancel each other out.¹⁴ Finally, because occasional buyers make a purchase only when $\epsilon = \bar{\epsilon}$, the per-period expected demand from occasional buyers is $\hat{d}^O(p^S, p^O, q) = \frac{\Delta\epsilon}{2} + p^S - p^O$.

We conclude by computing the newspaper's total number of readers. When $\epsilon_t = \bar{\epsilon}$, the total number is equal to

$$d^R(p^S, p^O, q) = d^S(p^S, p^O, q) + d^O(p^S, p^O, q) = \gamma q + \bar{\epsilon} - p^O. \quad (13)$$

When $\epsilon_t = \underline{\epsilon}$, the total number of readers coincides with the number of subscribers. Finally, the per-period expected number of readers is equal to

$$\hat{d}^R(p^S, p^O, q) = d^S(p^S, p^O, q) + \hat{d}^O(p^S, p^O, q) = \gamma q + \hat{\epsilon} - p^S. \quad (14)$$

Assumptions We suppose $\bar{\epsilon} < 1 - \alpha$ to focus on the case in which the market is *not* covered. We show in the appendix that this restriction on the readers' willingness to pay implies $d^R(p^S, p^O, q) < 1$. Further, we suppose $\gamma \in [0, \sqrt{2 - (\bar{\epsilon} + \alpha)}]$ to limit the number of cases to consider. In Proposition 3, we show this interval is large enough to generate the three possible predictions the model can produce regarding the relationship between reader prices and advertising revenues. We show in the appendix that this restriction also ensures the strict concavity of the newspaper's objective function in (p^S, p^O, q) . Finally, recall our

¹³The demand $d^O(p^S, p^O, q)$ is decreasing in $\underline{\epsilon}$ because a higher $\underline{\epsilon}$ makes it more tempting for readers to subscribe (given that $p^S \leq p^O$). Indeed, the demand $d^S(p^S, p^O, q)$ is increasing in $\underline{\epsilon}$.

¹⁴However, the feature whereby the demand from occasional buyers is less affected by quality than the demand for subscriptions should continue to hold under more general distributions.

focus on a scenario in which the newspaper sells both subscriptions and individual issues. As we show in the appendix, imposing $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$ ensures this outcome.¹⁵

When selling subscriptions and individual issues—that is, when setting p^O , p^S , and q such that $d^S(p^S, p^O, q) \geq 0$ and $d^O(p^S, p^O, q) \geq 0$ ¹⁶—the newspaper chooses p^O , p^S , and q to maximize its expected profits:

$$\Pi(p^S, p^O, q) = \Pi^O(p^S, p^O, q) + \Pi^S(p^S, p^O, q) + \Pi^A(p^S, p^O, q) - \frac{1}{2}q^2 \quad (15)$$

$$= p^O \left(\frac{\Delta\epsilon}{2} + p^S - p^O \right) + p^S (\gamma q + \underline{\epsilon} + p^O - 2p^S) + \alpha (bd^R + (1 - b)\hat{d}^R) - \frac{1}{2}q^2. \quad (16)$$

The associated system of first-order conditions is given by

$$\frac{\partial}{\partial p^S} \Pi(p^S, p^O, q) = 0 \iff 4p^S = 2p^O + \gamma q + \underline{\epsilon} - \alpha(1 - b) \quad (17)$$

$$\frac{\partial}{\partial p^O} \Pi(p^S, p^O, q) = 0 \iff p^O = p^S + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2} \quad (18)$$

$$\frac{\partial}{\partial q} \Pi(p^S, p^O, q) = 0 \iff q = \gamma(p^S + \alpha). \quad (19)$$

Analyzing the direct effect of changes in parameter values and choice variables is instructive. From (17), we see that an increase in p^O —because it raises the demand for subscriptions—tends to increase the subscription price p^S , all else equal. Similarly, equation (18) shows that an increase in p^S —because it increases the demand from occasional buyers—tends to increase the price p^O , again holding everything else equal. The prices on the reader side therefore have a tendency to co-move. To continue, an increase in q tends to increase p^S but has no direct effect on p^O . This asymmetric effect on prices occurs because a change in q has a direct effect on the demand for subscriptions, but not on the demand from occasional buyers. As we show below, this asymmetry can sometimes break the tendency for reader prices to co-move. To continue, the direct effect of an increase in advertising revenues (through a higher α) is to decrease both reader prices. As in the baseline model, the newspaper has stronger incentives to attract readers when advertisers' willingness to pay increases (the “waterbed” effect). Finally, and again as in the baseline model, (19) shows that an increase in advertisers' willingness to pay induces the newspaper to raise the quality of its content.

¹⁵One can verify the set of parameter values for which these constraints jointly hold is nonempty if and only if $\alpha \leq \frac{1}{2+b}$.

¹⁶From the construction of the demand functions, we found that the conditions p^O , p^S , and q must satisfy for $d^S(p^S, p^O, q) \geq 0$ and $d^O(p^S, p^O, q) \geq 0$ to hold are $p^O \leq \min[\gamma q + \bar{\epsilon}, p^S + \frac{\Delta\epsilon}{2}, 2p^S]$ and $p^S \leq \min[\frac{1}{2}(\gamma q + \underline{\epsilon} + p^O), \gamma q + \hat{\epsilon}, p^O]$. We anticipate these conditions hold, and show below that they do when $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$.

Solving the system of equations (17), (18), and (19) for p^O , p^S , and q yields the solution to the newspaper's problem, which we state in the next proposition.

Proposition 2 *Suppose $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$. Then, it is optimal for the newspaper to sell both subscriptions and individual issues by setting*

$$p^O = \frac{\hat{\epsilon} + \alpha}{2 - \gamma^2} - \alpha + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2} > p^S = \frac{\hat{\epsilon} + \alpha}{2 - \gamma^2} - \alpha,$$

and $q = \gamma \frac{\hat{\epsilon} + \alpha}{2 - \gamma^2}$. The "price gap" is then given by $p^O - p^S = \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}$.

Proof. See Appendix Section A.4. ■

In the Appendix, we show that selling both subscriptions and individual issues (as opposed to either subscriptions only, or individual issues only) is optimal for the newspaper whenever $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$.¹⁷ To gain intuition for these conditions, note we can rewrite $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon}$ as $\bar{\epsilon} \geq \hat{\epsilon} + \alpha b$, and recall that selling both subscriptions and individual issues is optimal to the extent that doing so allows the newspaper to charge a relative high price p^O to the occasional buyers, that is, to the readers with a low expected willingness to pay $\gamma q + \hat{\epsilon}$ but a high realized willingness to pay $\gamma q + \bar{\epsilon}$ for the issues with an associated shock $\epsilon = \bar{\epsilon}$. Similarly, recall a drawback of using subscriptions as a means to price discriminate is that readers with a high willingness to pay end up paying a subscription price lower than the total price they would be willing to pay absent the subscription. The condition $\underline{\epsilon} \geq \alpha(1 - b)$ limits this drawback by ensuring the expected willingness to pay $\gamma q + \hat{\epsilon} = \gamma q + \frac{\underline{\epsilon} + \bar{\epsilon}}{2}$ of subscribers is high enough that the newspaper can charge a relatively high subscription price np^S .

Also, much like in the baseline model, notice the newspaper's quality is increasing in both (i) the parameter γ capturing readers' sensitivity to quality and (ii) the parameter α capturing the advertisers' willingness to pay. The newspaper reacts to a drop in advertising revenues by lowering the quality of its content. Further, because $\gamma q = \gamma^2 \frac{\hat{\epsilon} + \alpha}{2 - \gamma^2}$, notice that, all else equal, the demand for subscriptions (11) decreases as α diminishes, where this decrease is larger the larger γ is. This observation is key to understanding the consequences on reader prices of changes in the newspaper's advertising revenues, which we analyze in the next proposition.

Finally, notice the price gap $p^O - p^S$ is increasing in $\Delta\epsilon$ – because $\Delta\epsilon = 2(\bar{\epsilon} - \hat{\epsilon})$ directly determines how high a price the newspaper is able to charge occasional readers versus subscribers, and thus the scope for price discrimination – and decreasing in advertising revenues. To see the latter comparative static, note that higher advertising revenues increase the

¹⁷The condition $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$ is sufficient to ensure it is profit-maximizing to sell both individual issues and subscriptions, but may not be necessary. Computing the weakest conditions under which it is profit-maximizing to sell both individual issues and subscriptions would require comparing the newspaper's expected profits when selling both subscriptions and individual issues to the newspaper's expected profits when (i) selling only individual issues and (ii) selling only subscriptions. Given our desire to focus on the case of empirical interest (in which the newspaper sells subscriptions and individual issues), we omit these tedious computations and suppose $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1 - b)$.

newspapers incentives to attract a large readership $d^R(p^O, q)$, and recall that the size of the readership is decreasing in p^O (but independent of p^S).

In what follows, let $\tilde{\gamma} = \min \left[\frac{2(1+b)}{2+b}, \sqrt{2 - (\bar{\epsilon} + \alpha)} \right]$, where $\tilde{\gamma} > 1$.

Proposition 3 *A decline in advertising revenues (a decrease in α) induces the newspaper to:*

1. *increase both prices if the readers' sensitivity to quality is low (i.e., if $\gamma < 1$),*
2. *increase p^O but decrease p^S if the readers' sensitivity to quality is intermediate (i.e., if $\gamma \in [1, \tilde{\gamma}]$), and*
3. *decrease both prices if the readers' sensitivity to quality is high (i.e., if $\gamma \in \left[\frac{2(1+b)}{2+b}, \sqrt{2 - (\bar{\epsilon} + \alpha)} \right]$).*

Moreover, a decline in advertising revenues (a decrease in α) always increases the price gap $p^O - p^S$, that is, always increases the extent of price discrimination.

Proof. These results immediately follow from differentiating the expressions stated in Proposition 2 with respect to α . ■

Whether the average subscription price p^S and the unit price p^O increase or decrease following a drop in advertising revenues depends on readers' sensitivity to quality. On the one hand, holding quality constant, the newspaper has an incentive to increase *both* prices following a drop in advertising revenues (the “waterbed effect”). As in the baseline model, this phenomenon occurs because the newspaper finds it less profitable to achieve a large readership. On the other hand, we know from Proposition 2 that the newspaper also reacts to lower advertising revenues by decreasing the quality of its content. This decrease in quality, all else equal, lowers the demand for subscriptions but leaves the demand from occasional readers unchanged. Moreover, the decrease in the demand for subscriptions is larger the larger γ is. As a result, when γ is low (i.e., $\gamma < 1$), the decrease in quality only slightly lowers the demand for subscriptions, so that the “waterbed effect” dominates and the newspaper raises both reader prices. For intermediate values of γ (i.e., if $\gamma \in [1, \tilde{\gamma}]$), the decrease in the demand for subscriptions is sufficiently large that the net effect on the subscription price p^S is negative. However, the decrease in p^S has only a moderate negative effect on the demand from occasional readers, so that the net change in p^O is positive. Finally, when γ is high (i.e., $\gamma \in \left[\frac{2(1+b)}{2+b}, \sqrt{2 - (\bar{\epsilon} + \alpha)} \right]$),¹⁸ the decrease in quality significantly lowers the demand for subscriptions, thereby calling for a large decrease in the subscription price p^S . In turn, the large decrease in p^S makes the demand from occasional readers fall sharply, inducing the newspaper to also lower the unit price p^O .

¹⁸Note this third case may not exist if parameters are such that the interval $\left[\frac{2(1+b)}{2+b}, \sqrt{2 - (\bar{\epsilon} + \alpha)} \right]$ is empty.

Finally, the extent of second-degree price discrimination – as measured by the “price gap” $p^O - p^S$ – increases following a drop in advertising revenues. When advertising revenues decline, the newspaper has lower incentives to attract a large readership $d^R(p^O, q)$ and it is then profit-maximizing to extract a higher price p^O from occasional readers.

A.4 Proof of Proposition 2

We begin by solving the newspaper’s problem, assuming it wishes to sell subscriptions and individual issues (Section A.4.1). In Section A.4.2, we verify the newspaper is better off selling subscriptions and individual issues rather than individual issues only. In Section A.4.3, we verify the newspaper is better off selling subscriptions and individual issues rather than subscriptions only. Throughout, we maintain the assumptions listed in Section A.3 (replacing $\gamma \in [0, \sqrt{2 - (\bar{\epsilon} + \alpha)}]$ with $\gamma \in [0, \sqrt{\frac{2 - (\bar{\epsilon} + \alpha)}{n}}]$).

A.4.1 Subscriptions and individual issues

We state the newspaper’s problem using expressions (10), (11), and (12). In what follows, we consider the general case with $n \geq 1$. The newspaper chooses p^O , p^S , and q to maximize

$$\Pi(p^S, p^O, q) = n\hat{\Pi}^O(p^S, p^O, q) + n\Pi^S(p^S, p^O, q) + n\Pi^A(p^S, p^O, q) - \frac{1}{2}q^2 \quad (20)$$

$$= np^O \left(\frac{\Delta\epsilon}{2} + p^S - p^O \right) + np^S (\gamma q + \underline{\epsilon} + p^O - 2p^S) + n \left(\alpha (bd^R + (1-b)\hat{d}^R) \right) - \frac{1}{2}q^2, \quad (21)$$

subject to

$$p^O \leq \min \left[\gamma q + \bar{\epsilon}, p^S + \frac{\Delta\epsilon}{2}, 2p^S \right], \quad (22)$$

$$p^S \leq \min \left[\gamma q + \hat{\epsilon}, \frac{1}{2}(\gamma q + \underline{\epsilon} + p^O), p^O \right]. \quad (23)$$

As argued when constructing the demand functions, constraints (22) and (23) must necessarily hold for the newspaper to potentially sell both subscriptions and individual issues (i.e., for $d^S(p^S, p^O, q) \geq 0$ and $d^O(p^S, p^O, q) \geq 0$). We proceed by ignoring (22) and (23) and show below that the solution to the unconstrained problem satisfies these constraints whenever $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1-b)$. Expression (20) also assumes $d^O(p^S, p^O, q) \leq 1$, $d^S(p^S, p^O, q) \leq 1$, and $d^R(p^S, p^O, q) \leq 1$. We show below these conditions are necessarily met when $\bar{\epsilon} + \alpha < 1$. Similarly, we postpone the proof that (20) is strictly concave in (p^S, p^O, q) .

The associated system of first-order conditions is given by

$$\frac{\partial}{\partial p^S} \Pi(p^S, p^O, q) = 0 \iff 4p^S = 2p^O + \gamma q + \underline{\epsilon} - \alpha(1-b), \quad (24)$$

$$\frac{\partial}{\partial p^O} \Pi(p^S, p^O, q) = 0 \iff p^O = p^S + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}, \quad (25)$$

$$\frac{\partial}{\partial q} \Pi(p^S, p^O, q) = 0 \iff q = n\gamma(p^S + \alpha). \quad (26)$$

Solving the system of equations (24)-(26) for p^S , p^O , and q yields

$$p^S = \frac{\hat{\epsilon} + \alpha}{2 - n\gamma^2} - \alpha, \quad (27)$$

$$p^O = \frac{\hat{\epsilon} + \alpha}{2 - n\gamma^2} - \alpha + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}, \quad (28)$$

$$q = n\gamma \frac{\hat{\epsilon} + \alpha}{2 - n\gamma^2}. \quad (29)$$

We now verify the constraints (22) and (23) indeed hold. To see $p^O \leq p^S + \frac{\Delta\epsilon}{2}$, note $p^O = p^S + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}$ and $\frac{\Delta\epsilon}{4} - \frac{\alpha b}{2} < \frac{\Delta\epsilon}{2}$. Further, one immediately derives that $p^S \leq p^O$ if and only if $\Delta\epsilon \geq 2\alpha b$. To verify that $p^S \leq \gamma q + \hat{\epsilon}$, note $\gamma q - p^S = n(\gamma^2 - 1)(\frac{\hat{\epsilon} + \alpha}{2 - n\gamma^2}) + \alpha$. When $\gamma = 0$, $p^S = \frac{\hat{\epsilon} - \alpha}{2} < \hat{\epsilon}$. Because $\gamma q - p^S$ is increasing in γ , it follows $p^S \leq \gamma q + \hat{\epsilon}$ always. To verify $p^O \leq \gamma q + \bar{\epsilon}$, note $\gamma q - p^O = n(\gamma^2 - 1)(\frac{\hat{\epsilon} + \alpha}{2 - n\gamma^2}) + \alpha - (\frac{\Delta\epsilon}{4} - \frac{\alpha b}{2})$ is also increasing in γ . Suppose $\gamma = 0$ and recall $p^S < \hat{\epsilon}$ when $\gamma = 0$. Because $p^O = p^S + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}$, it follows that $p^O \leq \hat{\epsilon} + (\frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}) \leq \hat{\epsilon} + \frac{\Delta\epsilon}{2} = \bar{\epsilon}$. Because $\gamma q - p^O$ is increasing in γ , it follows that $p^O \leq \gamma q + \bar{\epsilon}$ always holds. Moreover, to see $p^S \leq \frac{1}{2}(\gamma q + \underline{\epsilon} + p^O)$, note $\gamma q + \underline{\epsilon} + p^O - 2p^S = \frac{(n\gamma^2 - 1)}{2 - n\gamma^2}(\hat{\epsilon} + \alpha) + \underline{\epsilon} + \alpha + \frac{\Delta\epsilon}{4} - \frac{\alpha b}{2}$. Suppose $\gamma = 0$. One immediately verifies $\gamma q + \underline{\epsilon} + p^O - 2p^S \geq 0$ necessarily. Because the left-hand side is increasing in γ , it follows that $p^S \leq \frac{1}{2}(\gamma q + \underline{\epsilon} + p^O)$ always. One can also verify that $p^O \leq 2p^S \forall \gamma$ whenever $\underline{\epsilon} \geq \alpha(1-b)$. To conclude, the solution to the unconstrained problem satisfies (22) and (23) if and only if $\bar{\epsilon} - 2\alpha b \geq \underline{\epsilon} \geq \alpha(1-b)$, where the two inequalities can jointly hold if and only if $\alpha \leq \frac{1}{1+b}$.

Finally, by following similar steps, one can show $\alpha + \bar{\epsilon} < 1$ and $\gamma \in [0, \sqrt{\frac{2-\bar{\epsilon}-\alpha}{n}}]$ together imply $d^R(p^S, p^O, q) \leq 1$, which, in turn, implies $d^S(p^S, p^O, q) \leq 1$ and $d^O(p^S, p^O, q) \leq 1$. One verifies the set of parameter values such that all conditions hold is nonempty if and only if $\alpha \leq \frac{1}{2+b}$.

We conclude the analysis of the case in which the newspaper sells subscriptions and individual issues, by verifying the objective function (20) is strictly concave in (p^S, p^O, q) . The Hessian matrix H associated to (20) is given by

$$\begin{pmatrix} \frac{\partial^2 \Pi}{\partial p^S \partial p^S} & \frac{\partial^2 \Pi}{\partial p^S \partial p^O} & \frac{\partial^2 \Pi}{\partial p^S \partial q} \\ \frac{\partial^2 \Pi}{\partial p^O \partial p^S} & \frac{\partial^2 \Pi}{\partial p^O \partial p^O} & \frac{\partial^2 \Pi}{\partial p^O \partial q} \\ \frac{\partial^2 \Pi}{\partial q \partial p^S} & \frac{\partial^2 \Pi}{\partial q \partial p^O} & \frac{\partial^2 \Pi}{\partial q \partial q} \end{pmatrix} = \begin{pmatrix} -4n & 2n & n\gamma \\ 2n & -2n & 0 \\ n\gamma & 0 & -1 \end{pmatrix}$$

We verify H is negative definite. Because H is real and symmetric, it has three real eigenvalues. To compute these eigenvalues, we solve for the polynomial $P(\lambda)$ representing the determinant of

$$\begin{vmatrix} -4n - \lambda & 2n & n\gamma \\ 2n & -2n - \lambda & 0 \\ n\gamma & 0 & -1 - \lambda \end{vmatrix}$$

We obtain $P(\lambda) = (-4n - \lambda)(-2n - \lambda)(-1 - \lambda) - 2n(2n)(-1 - \lambda) + n\gamma(-n\gamma)(-2n - \lambda)$. Let λ_1 , λ_2 , and λ_3 denote the three real solutions of $P(\lambda) = 0$. By definition, these solutions are the three eigenvalues of H . If all three eigenvalues of H are positive, all coefficients in $P(\lambda)$ must either be positive or negative. Rewrite $P(\lambda)$ as $P(\lambda) = -\lambda^3 + (-1 - 6n)\lambda^2 + (-6n - 4n^2 + n^2\gamma^2)\lambda + (-4n^2 + 2n^3\gamma^2)$. Because the coefficients associated with λ^2 and λ^3 are negative, we verify the other two coefficients are also negative. One immediately shows they are $\forall \gamma \in \left[0, \sqrt{\frac{2-\bar{\epsilon}-\alpha}{n}}\right]$.

A.4.2 Individual issues only

We now show the newspaper is strictly better off selling both subscriptions and individual issues rather than individual issues only.

To begin with, note that in the problem analyzed in Section A.4.1, the newspaper could have replicated the same expected profits as when selling individual issues only, by setting $p^S = p^O$. To see this, note that when $p^S = p^O$, the readers whose outside option $\underline{u}_i \leq \gamma q + \underline{\epsilon} - p^O$ are payoff-indifferent regarding whether to subscribe or purchase every issue separately (so that they generate the same expected revenue np^O independently of their decision regarding whether to subscribe). Thus, if the newspaper sets $p^O > p^S$ in the problem analyzed in Section A.4.1 (which occurs whenever $\Delta\epsilon > 2\alpha b$), it must be better off selling both subscriptions and individual issues rather than selling individual issues only.

A.4.3 Subscriptions only

We now show the newspaper is strictly better off selling both subscriptions and individual issues rather than subscriptions only. To begin with, note the newspaper can sell subscriptions by either (i) setting p^S high enough that only the readers willing to read all n issues subscribe or (ii) setting p^S low enough that it is also optimal for some readers willing to read only half the issues on average to subscribe. Specifically, the threshold on p^S that determines which of the two cases is the relevant one is $\frac{\Delta\epsilon}{2}$.

Suppose first $p^S \leq \frac{\Delta\epsilon}{2}$, so that some subscribers read all n issues, whereas others read only half the issues on average. Denote by p^{S*} the solution to the associated optimization

problem. By an argument similar to that developed in Section A.4.2, we note the newspaper could have replicated the same outcome by setting $p^S = p^O = p^{S*}$ in the problem analyzed in Section A.4.1, *but chose not to*. It follows that the newspaper is strictly better off selling both subscriptions and individual issues (at different prices), rather than selling subscriptions only by setting $p^S \leq \frac{\Delta\epsilon}{2}$.

Suppose now $p^S \geq \frac{\Delta\epsilon}{2}$. The demand for subscriptions is then equal to $d^S(p^S, q) = \gamma q + \hat{\epsilon} - p^S$, and the newspaper chooses p^S and q to maximize its expected profits:

$$\Pi(p^S, q) = n(p^S + \alpha)(\gamma q + \hat{\epsilon} - p^S) - \frac{q^2}{2}, \quad (30)$$

subject to $0 \leq d^S(p^S, q) \leq 1$ and $p^S \geq \frac{\Delta\epsilon}{2}$. One verifies objective function (30) is strictly concave in (p^S, q) if and only if $\gamma < \sqrt{\frac{2}{n}}$, which must necessarily hold given that $\gamma < \sqrt{\frac{2-\bar{\epsilon}-\alpha}{n}}$. Solving the unconstrained problem yields $p^S = \frac{\alpha(n\gamma^2-1)+\hat{\epsilon}}{2-n\gamma^2}$ and $q = n\gamma(\frac{\alpha+\hat{\epsilon}}{2-n\gamma^2})$.

It follows that the newspaper is strictly better off selling both subscriptions and individual issues rather than subscriptions only (by setting $p^S \geq \frac{\Delta\epsilon}{2}$) because, in the *unconstrained* version of the problem analyzed in Section A.4.1, it could have set the objective function (20) equal to the objective function (30) (evaluated at $p^S = \frac{\alpha(n\gamma^2-1)+\hat{\epsilon}}{2-n\gamma^2}$ and $q = n\gamma(\frac{\alpha+\hat{\epsilon}}{2-n\gamma^2})$) by setting $p^S = \frac{\alpha(n\gamma^2-1)+\hat{\epsilon}}{2-n\gamma^2}$, $q = n\gamma(\frac{\alpha+\hat{\epsilon}}{2-n\gamma^2})$, and $p^O = p^S + \frac{\Delta\epsilon}{2}$, *but chose not to*. Because the solution to the unconstrained problem analyzed in Section A.4.1 was feasible (i.e., it satisfied all the constraints), it follows that the objective function (20) (evaluated at the solution (29)-(30)-(31)) must be strictly higher than the objective function (30) (evaluated at $p^S = \frac{\alpha(n\gamma^2-1)+\hat{\epsilon}}{2-n\gamma^2}$ and $q = n\gamma(\frac{\alpha+\hat{\epsilon}}{2-n\gamma^2})$).

B Data sources

B.1 Newspaper data

B.1.1 List of the newspapers included in our dataset

We construct an annual panel dataset on local and national newspapers in France between 1960 and 1974. Our dataset includes data for 12 national newspapers and 68 local newspapers.

National newspapers *L’Aurore; Combat; La Croix; Les Echos; Le Figaro; France Soir; L’Humanité; Le Monde; Paris Jour; Paris Presse; Le Parisien Libéré.*

Local newspapers *L’Alsace; L’Ardennais; Le Berry Républicain; Le Bien Public; Centre Presse; La Charente Libre; Le Courrier De Bayonne; Le Courrier De L’Ouest; Le Courrier De Saone Et Loire; Le Courrier Picard; Le Dauphiné Libéré; La Dépêche Du Midi; Les Dépêches Du Doubs; Les Dernières Nouvelles D’Alsace; La Dordogne Libre; L’Echo De La Corrèze; L’Echo Du Centre; L’Echo Républicain; L’Eclair De Nantes; L’Eclair Des Pyrénées; L’Espoir ; L’Espoir De Nice Et De La Cote D’Azur; L’Est Eclair; L’Est Républicain; L’Eveil De La Haute Loire; France La Nouvelle République; La Haute Marne Libérée; Le Havre Libre; Le Havre Presse; L’Indépendant; Le Journal Du Centre; Libération Champagne; La Liberté; La Liberté De L’Est; La Liberté De Normandie; La Liberté Du Morbihan; Le Maine Libre; La Marseillaise; Le Méridional La France; Le Midi Libre; La Montagne; La Montagne Noire; Nice Matin; Nord Eclair; Nord Littoral; Nord Matin; Le Nouvel Alsacien; La Nouvelle Gazette De Biarritz; La Nouvelle République Des Pyrénées; La Nouvelle République Du Centre Ouest; Ouest France; Paris Normandie; Le Petit Bleu De L’Agenais; Le Populaire Du Centre; La Presse De La Manche; Presse Océan; Le Progrès De Lyon; Le Provençal; Le Républicain Lorrain; La République; La République Des Pyrénées; La République Du Centre Independant De L’Eure; Sud Ouest; Le Télégramme; La Tribune Le Progrès; L’Union; La Voix Du Nord; L’Yonne Républicaine.*

B.1.2 Newspapers’ prices and revenues

We collect for national and local daily newspapers between 1960 and 1974 a number of important economic indicators, namely sales, profits, and operating revenues (revenues from sales and revenues from advertising).

The data is 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 circulation. For local daily newspapers, the data is from Cagé (2017). We collect additional data for national daily newspapers.

B.1.3 Newspapers' content and advertising

We collect data on the number of pages and on the amount of advertising per newspaper issue directly from the paper version of the newspapers available in the French National Library. For each year and each newspaper, we select two weeks – the third week of March (the choice of this week was dictated by the fact that this is the week used by the French National Institute of Statistics and Economic Studies to run its surveys) and the third week of December. We measure the quantity of advertising on each page. We thus have information on the total amount of advertising in newspapers, as well as the share of the newspaper that is devoted to advertising.

B.1.4 Newspapers' circulation

We collect information on aggregate newspaper circulation at the newspaper level. The circulation data is from the French Ministry of Information's non-publicly available records in the National archives described above.

B.1.5 Number of journalists

We have annual information on the number of journalists working for each newspaper. This data is from Cagé (2016).

B.1.6 Readership survey

For a subset of the newspapers included in our sample, we obtain information on readers' characteristics. The readership data were compiled by the *Centre d'Etude des Supports de Publicité* (CESP), a French interprofessional association composed of all the main companies operating in the advertising industry. The CESP has published a study of French newspaper readers (*Etude sur les lecteurs de la presse française*) every five years between 1957 and 1967 and annually starting in 1968. The representative sample used in the survey is drawn from all French citizens aged 18 or more living in metropolitan France. It is a random sample which includes between 250,000 and 300,000 individuals depending on the year. The survey is conducted using a questionnaire whose main objective is to collect information regarding readership habits (whether one or more newspapers were read and, if so, which) of French citizens at the time of the survey. The survey is available in paper format in the CESP. We digitized it for the following years: 1957, 1962, 1967, 1968, 1969, 1970, 1972, 1974.

B.1.7 ORTF reports

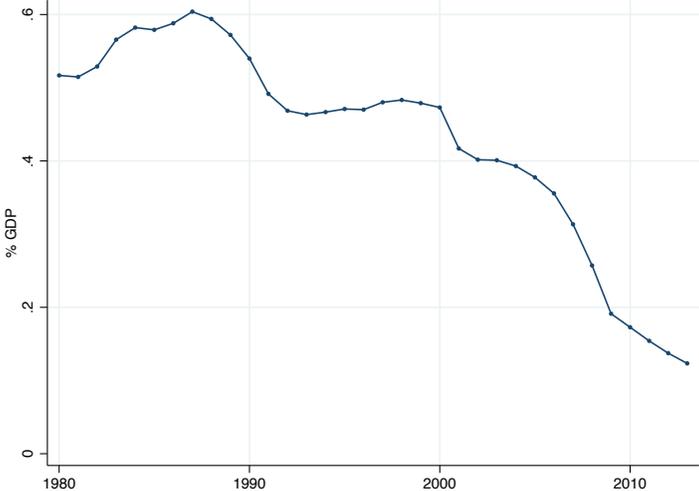
We collect information on the quality of television content from the annual ORTF reports, and in particular the first and third volumes of the *Rapport d'activité ORTF*. These reports

were available in the French National Library (BNF) and in the national archives. They cover the 1962-1975 period, with two missing years (1967 and 1975). (In 1972 and 1973, the reports are called *Rapport annuel sur les moyens ORTF.*)

B.1.8 Postage and Train Rates

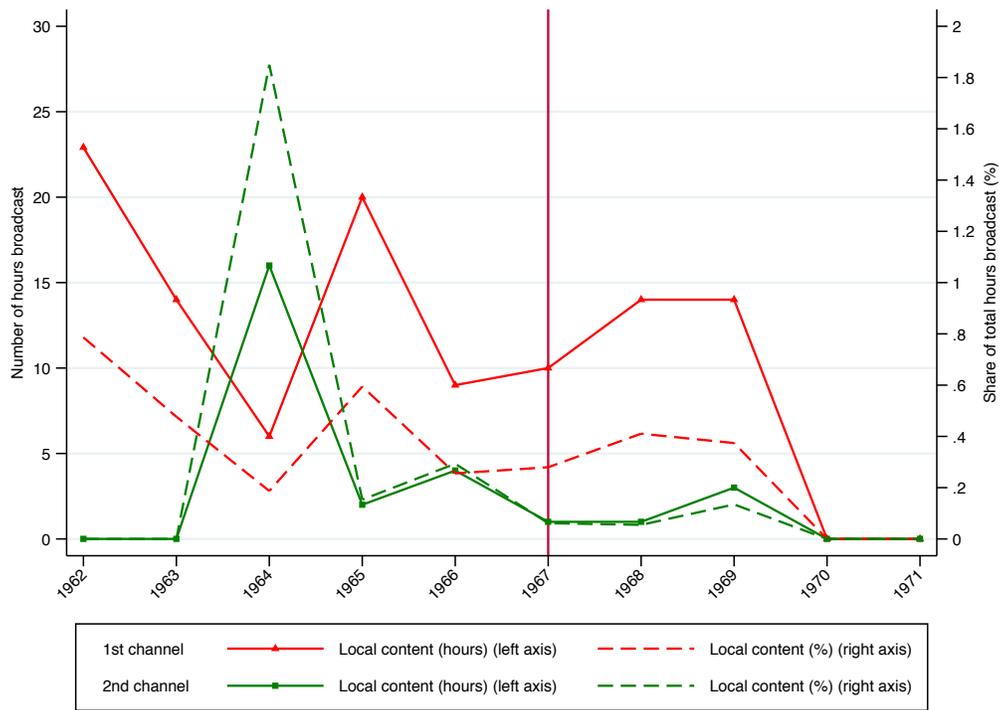
We collect information on postage and train subsidized rates from an annual industry publication called *Cahiers de la presse française* published by an association of national and local newspapers (*Fédération nationale de la presse hebdomadaire et périodique*). These reports were available in the French National Library (BNF) in Paris. They cover the 1963-1974 period.

C Additional figures



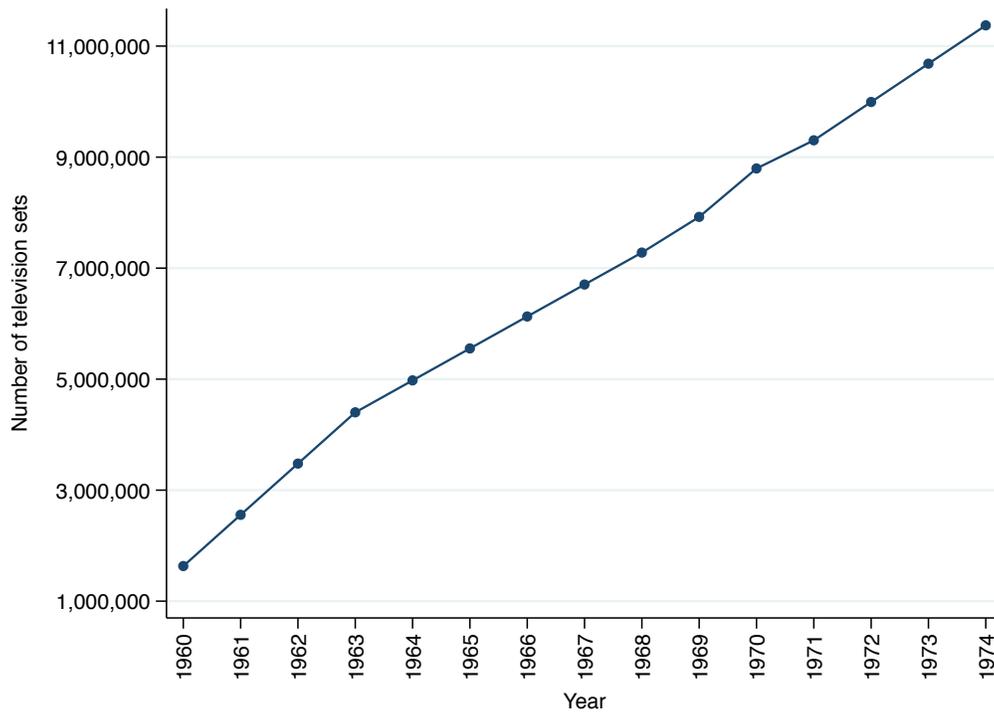
Notes: The figure represents the evolution of newspaper advertising revenues as a share of GDP in the United States between 1980 and 2013. Data on newspaper revenues are from the Newspaper Association of America (NAA). GDP data are from the World Development Indicators (WDI).

Figure C.1: Newspaper advertising revenues as a share of GDP in the United States, 1980-2103



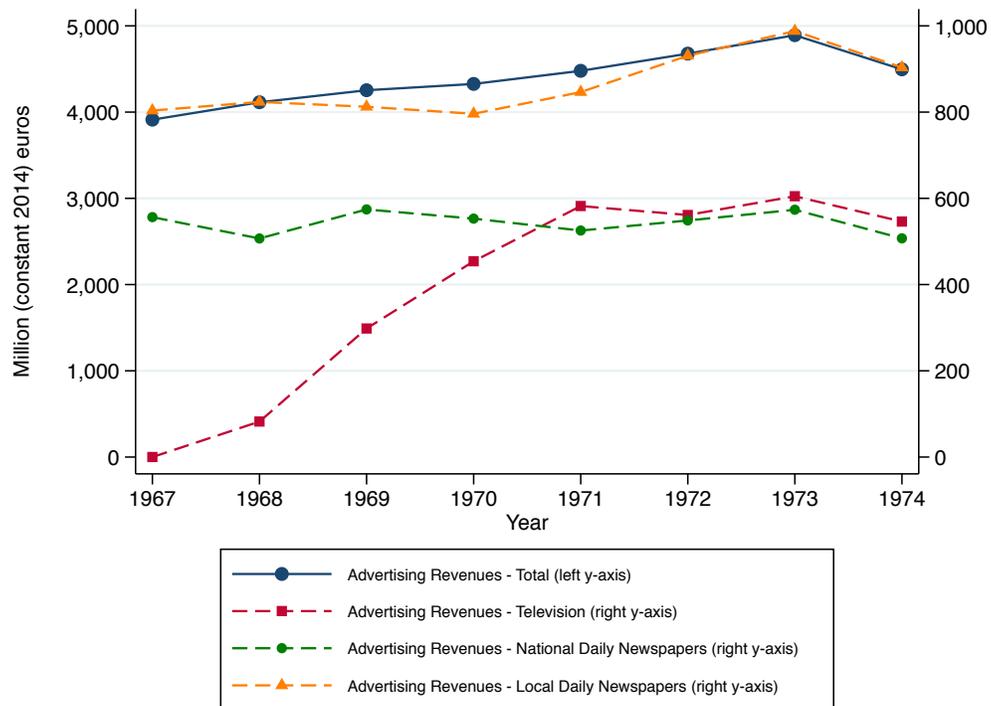
Notes: The figure shows the evolution of the local content broadcast on French television from 1962 to 1971.

Figure C.2: Local content broadcast on French television



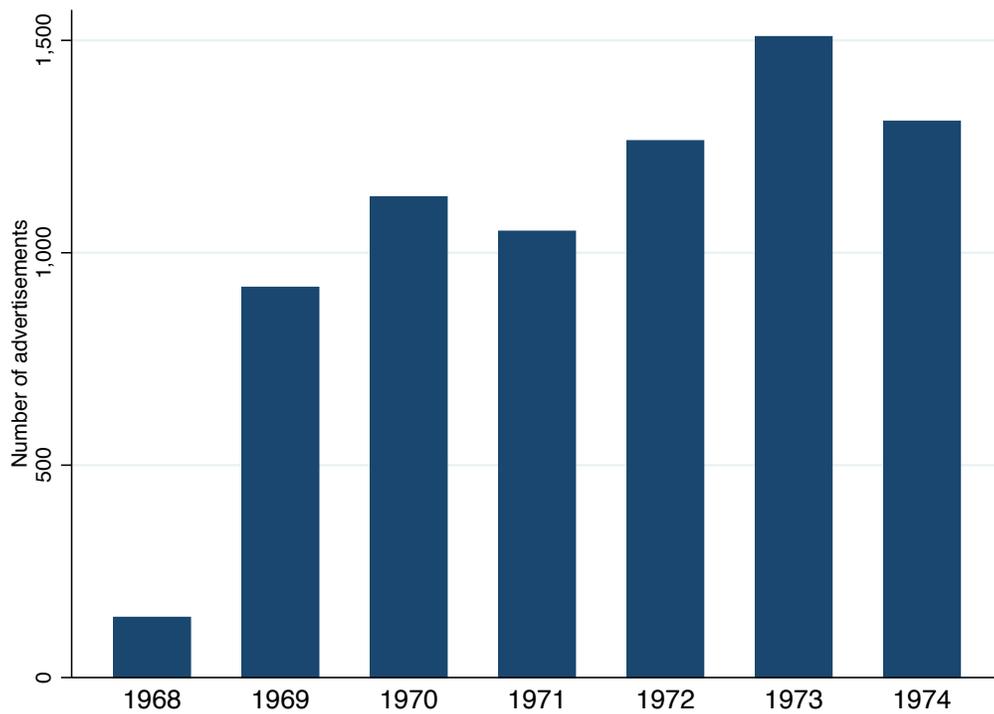
Notes: The figure represents the evolution of television penetration in France between 1960-1974. Data on television equipment is from studies conducted for the advertising market (PROSCOP).

Figure C.3: Number of television sets in France, 1960-1974



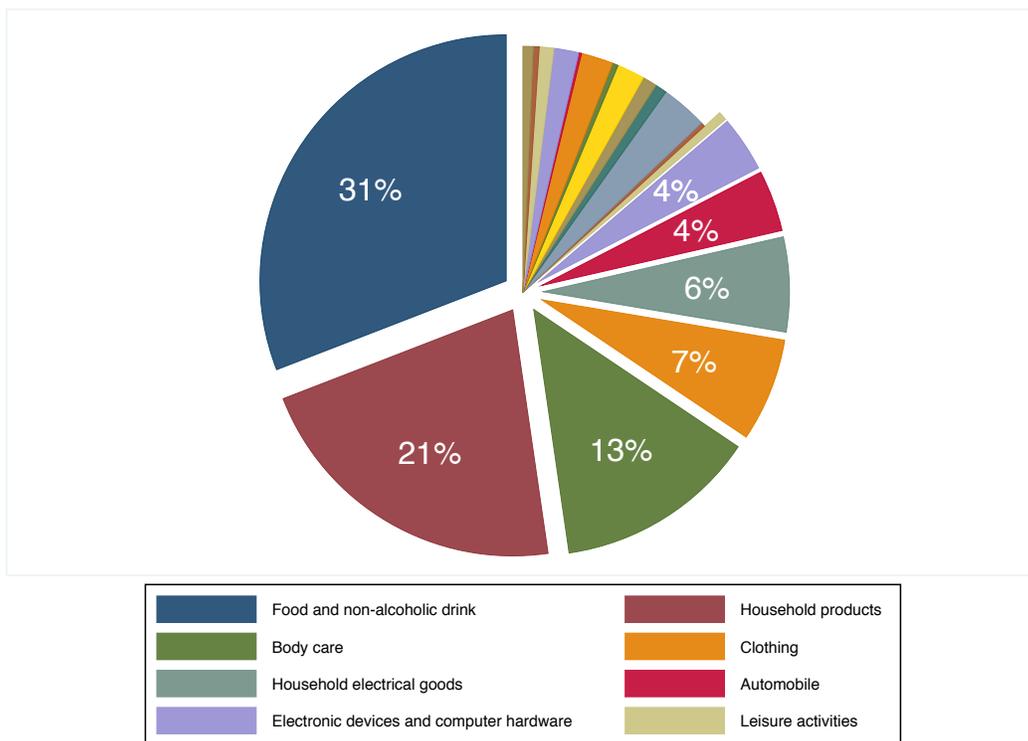
Notes: The figure shows for each year between 1967 and 1974 the evolution of advertising revenues in France by media outlets (television, local and national daily newspapers). Advertising revenues are in (constant 2014) million euros. Data are from the IREP.

Figure C.4: Advertising Revenues, 1967-1974, by Media Outlets, (Constant 2014) Million Euros



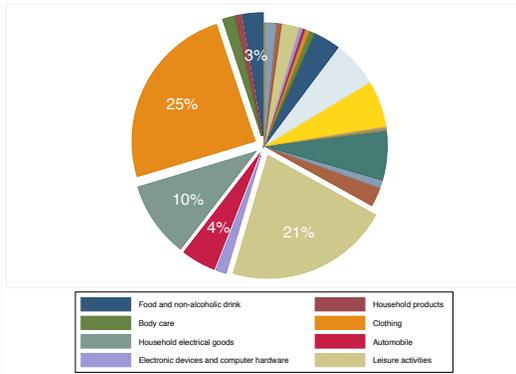
Notes: The figure shows the total number of new advertisements broadcast every year on French Television between 1968 and 1974.

Figure C.5: Number of new advertisements broadcasted on Television, 1968-1974

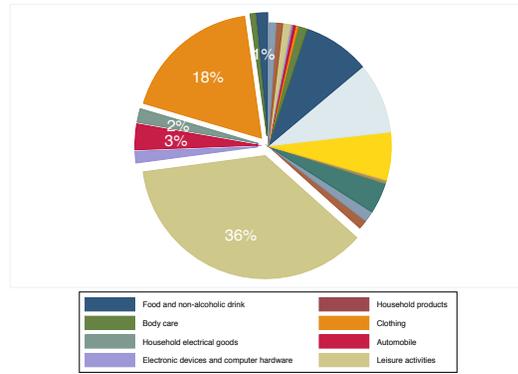


Notes: The figure illustrates the diversity of advertisements on French television.

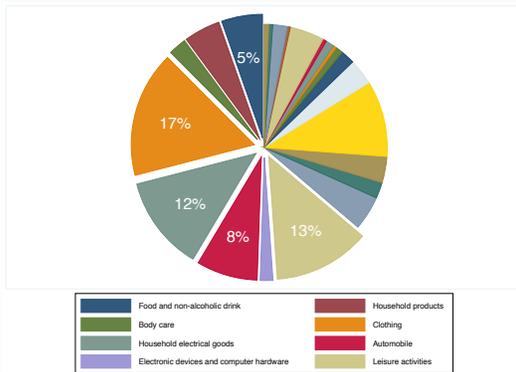
Figure C.6: Television advertisements by category, 1967



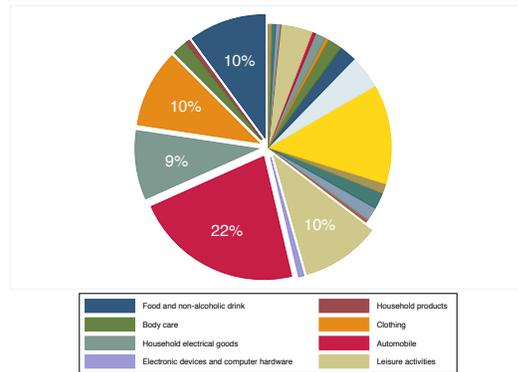
(a) National newspapers – 1966



(b) National newspapers – 1971



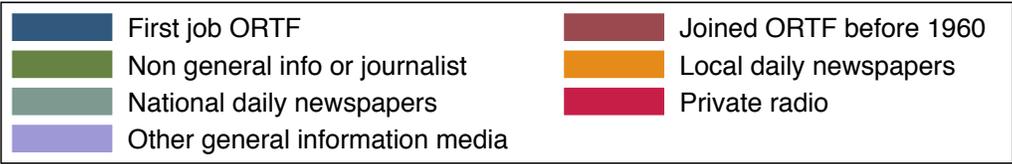
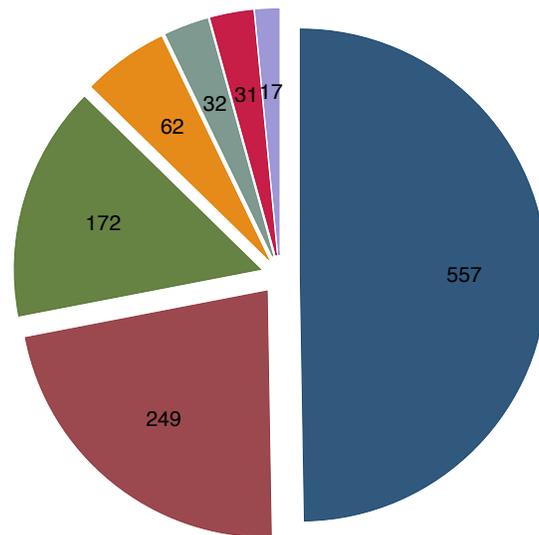
(c) Local newspapers – 1966



(d) Local newspapers – 1971

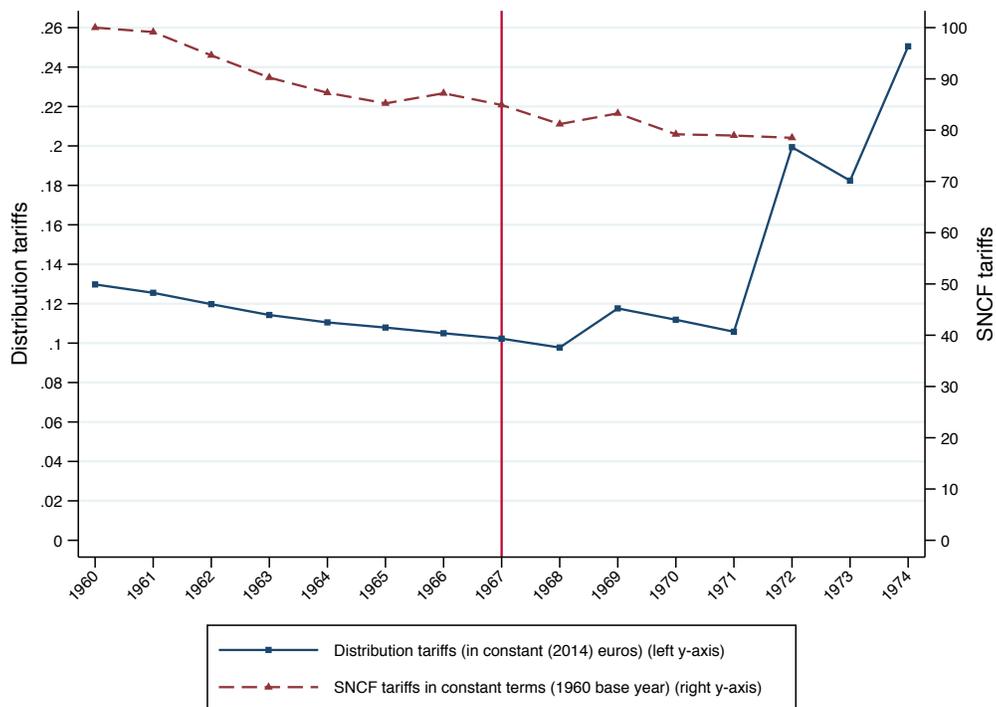
Notes: The figure illustrates the diversity of advertisements on national and local daily newspapers. Upper Figures C.7a and C.7b show the prevalence of the various categories of advertisements in national newspapers in 1966 and 1971, respectively. Bottom Figures C.7c and C.7d show this prevalence for local daily newspapers.

Figure C.7: Newspaper advertisements by category, 1966 & 1971



Notes: The figure shows the professional origin of the 1,120 journalists working for the ORTF in 1974.

Figure C.8: Professional origin of the 1,120 journalists working for the ORTF in 1974



Notes: The figure shows the evolution of the subsidized postage and train rates. The postage rate is defined as the rate charged by “La Poste” to a newspaper company for the delivery anywhere in metropolitan France of one newspaper unit weighting between 60 to 100 grams. The train rate is defined as the rate charged by the “SNCF” to a newspaper company for transportation anywhere in metropolitan France of one newspaper unit. Data are from the “*Cahiers de la presse française*” published by the “*Fédération nationale de la presse hebdomadaire et périodique*.”

Figure C.9: Evolution of postage and train rates, 1960-1974

D Robustness checks

Table D.1: Robustness check: Bootstrapped standard errors

	Ad revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.23* (0.12)	-0.40*** (0.11)	-0.11*** (0.02)	0.23* (0.14)	-0.21*** (0.06)	-0.04 (0.08)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.52	0.19	0.89	0.12	0.50	0.52
Adjusted R-sq	0.47	0.09	0.88	0.04	0.45	0.48
Observations	1,052	809	1,044	1,044	1,046	1,046

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Time period is 1960-74. Models are estimated using OLS estimations. Standard errors are bootstrapped with 1,000 replications. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.2: Robustness check: Dropping 1968

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.25* (0.12)	-0.41*** (0.11)	-0.11*** (0.02)	0.25* (0.14)	-0.22*** (0.06)	-0.05 (0.08)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.54	0.19	0.88	0.13	0.50	0.53
Adjusted R-sq	0.53	0.18	0.88	0.11	0.50	0.53
Observations	975	740	968	968	975	974

Notes: * p<0.10, ** p<0.05, *** p<0.01. Time period is 1960-74, excluding year 1968. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.3: Robustness check: Focusing on 1960-1971

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.19* (0.11)	-0.35*** (0.09)	-0.09*** (0.02)	0.21 (0.13)	-0.15*** (0.05)	-0.02 (0.07)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.49	0.20	0.86	0.15	0.50	0.48
Adjusted R-sq	0.48	0.19	0.86	0.14	0.50	0.47
Observations	837	632	832	832	845	848

Notes: * p<0.10, ** p<0.05, *** p<0.01. Time period is 1960-71. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.4: Robustness check: Focusing on 1964-1971

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.16* (0.08)	-0.34*** (0.08)	-0.09*** (0.03)	0.06 (0.11)	-0.11*** (0.04)	-0.02 (0.07)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.31	0.20	0.84	0.01	0.42	0.33
Adjusted R-sq	0.30	0.19	0.84	-0.00	0.41	0.32
Observations	604	538	601	601	564	571

Notes: * p<0.10, ** p<0.05, *** p<0.01. Time period is 1964-71. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.5: Robustness check: dropping *Paris Jour* & *Paris Presse*

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.23* (0.13)	-0.38*** (0.11)	-0.11*** (0.02)	0.32** (0.14)	-0.19*** (0.07)	-0.04 (0.09)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.55	0.19	0.89	0.16	0.50	0.53
Adjusted R-sq	0.54	0.17	0.89	0.14	0.50	0.52
Observations	1,033	787	1,024	1,024	1,022	1,026

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Time period is 1960-74. *Paris Jour* and *Paris Presse* are excluded from the estimation. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.6: Robustness check: Industry specific time trend

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.15** (0.07)	-0.35*** (0.10)	-0.10*** (0.02)	0.25* (0.13)	-0.17*** (0.06)	-0.05 (0.07)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.71	0.19	0.89	0.13	0.51	0.52
Adjusted R-sq	0.71	0.18	0.89	0.12	0.51	0.52
Observations	1,031	809	1,044	1,044	1,046	1,046

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Time period is 1960-74. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects as well as an industry-specific time trend. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.7: Robustness check: Excluding large regional newspapers

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.25** (0.12)	-0.41*** (0.11)	-0.11*** (0.02)	0.23* (0.14)	-0.20*** (0.06)	-0.05 (0.08)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.55	0.20	0.88	0.12	0.48	0.51
Adjusted R-sq	0.54	0.18	0.88	0.11	0.47	0.51
Observations	979	745	969	969	956	971

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Time period is 1960-74. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects as well as an industry-specific time trend. The dependent variables are in logarithm. Variables are described in more details in the text. Compared to the main specification, the following “large regional newspapers” are excluded: *Centre Presse*, *Le Dauphiné Libéré*, *La Dépêche Du Midi*, *L’Echo Du Centre*, *La Montagne*, and *La Tribune Le Progrès*.

Table D.8: Robustness check: Weighting newspapers depending on their circulation

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.19* (0.10)	-0.37*** (0.07)	-0.11*** (0.01)	0.49*** (0.15)	-0.26*** (0.09)	-0.15* (0.08)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.42	0.26	0.92	0.34	0.38	0.50
Adjusted R-sq	0.42	0.25	0.92	0.33	0.37	0.49
Observations	1,052	807	1,034	1,034	1,045	1,031

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Time period is 1960-74. Models are estimated using OLS estimations. Newspapers are weighted depending on their circulation. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text.

Table D.9: Robustness check: Non-missing dependent variables

	Ad revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.23* (0.13)	-0.41*** (0.11)	-0.13*** (0.02)	0.11 (0.13)	-0.17*** (0.06)	-0.06 (0.07)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.47	0.22	0.91	0.05	0.41	0.48
Adjusted R-sq	0.46	0.21	0.91	0.04	0.40	0.47
Observations	695	695	695	695	695	695

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Time period is 1960-74. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Compared to the main specification, all the six dependent variables are non-missing in all the estimations here, so that the six regressions are performed on the same sample. Variables are described in more details in the text.

Table D.10: Robustness check: Dropping local newspapers that are in a monopolistic situation

(a) Only *La Nouvelle République Du Centre Ouest* and *Ouest France*

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.23* (0.12)	-0.40*** (0.11)	-0.11*** (0.02)	0.24* (0.14)	-0.21*** (0.06)	-0.04 (0.08)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.51	0.19	0.88	0.13	0.49	0.52
Adjusted R-sq	0.51	0.17	0.88	0.11	0.48	0.51
Observations	1,023	784	1,015	1,015	1,016	1,016

(b) All 5

	Advertising revenues	(Listed) Ad price	Subscription price	Share of subscribers	Number of journalists	Newshole
National x Post-TV Ad	-0.23* (0.12)	-0.41*** (0.11)	-0.11*** (0.02)	0.24* (0.14)	-0.21*** (0.06)	-0.05 (0.08)
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.51	0.19	0.88	0.13	0.48	0.51
Adjusted R-sq	0.50	0.17	0.88	0.12	0.47	0.50
Observations	988	750	981	981	971	972

Notes: * p<0.10, ** p<0.05, *** p<0.01. Time period is 1960-74. Models are estimated using OLS estimations. Standard errors are clustered at the newspaper level. All the estimations include newspaper and year fixed effects. The dependent variables are in logarithm. Variables are described in more details in the text. Compared to the main specification, *La Nouvelle République Du Centre Ouest* and *Ouest France* are excluded in the upper Table D.10a. In the bottom Table D.10b, the following five newspapers are excluded: *La Nouvelle République Du Centre Ouest*, *Ouest France*, *La Dépêche du Midi*, *La Montagne*, and *L'Union*.

References

- Adams, W. and Yellen, J. L. (1976). Commodity Bundling and the Burden of Monopoly. *The Quarterly Journal of Economics*, 90(3):475–498.
- Anderson, S. and Jullien, B. (2015). Advertising Finance and Two Sided Business Models. In Anderson, S., Waldfogel, J., and Stromberg, D., editors, *Handbook of Media Economics*, chapter 2. North Holland.
- Asplund, M., Eriksson, R., and Strand, N. (2008). Price Discrimination in Oligopoly: Evidence from Regional Newspapers. *The Journal of Industrial Economics*, 56(2):333–346.
- Borenstein, S. (1991). Selling Costs and Switching Costs: Explain Retail Gasoline Margins. *RAND Journal of Economics*, 20(3):344–365.
- Borenstein, S. and Rose, R. (1994). Competition and Price Dispersion in the U.S. Airline Industry. *Journal of Political Economy*, 103(2):653–683.
- Busse, M. and Rysman, M. (2005). Competition and Price Discrimination in Yellow Pages Advertising. *Rand Journal of Economics*, 36(2):378–390.
- Cagé, J. (2016). Payroll and Inequality within the Newsroom: Evidence from France, 1936-2016. Working paper, SciencesPo Paris.
- Cagé, J. (2017). Media Competition, Information Provision and Political Participation: Evidence from French Local Newspapers and Elections, 1944-2014. CEPR Discussion Papers 12198, C.E.P.R. Discussion Papers.
- Carroni, E. (2015). Competitive Behaviour-Based Price: Discrimination among Asymmetric Firms. Working Papers 1501, University of Namur, Department of Economics.
- Dai, M., Liu, Q., and Serfes, K. (2012). Is the Effect of Competition on Price Dispersion Non-Monotonic? Evidence from the U.S. Airline Industry. Working paper.
- Ellman, M. and Germano, F. (2009). What Do That Papers Sell? A Model of Advertising and Media Bias. *The Economic Journal*, 119(537):680–704.
- Gabszewicz, J. and Sonnac, N. (1997). Subscription as a price discrimination device. CORE Discussion Papers 1997090, Université catholique de Louvain, Center for Operations Research and Econometrics (CORE).
- Gentzkow, M., Glaeser, E., and Goldin, C. (2006). The Rise of the Fourth Estate: How Newspapers Became Informative and Why It Mattered. In *Corruption and Reform: Lessons from America's Economic History*. National Bureau of Economic Research.

- Gerardi, K. S. and Shapiro, A. H. (2009). Does Competition Reduce Price Dispersion? New Evidence from the Airline Industry. *Journal of Political Economy*, 117(1):1–37.
- Gil, R. and Riera-Crichton, D. (2011). Price discrimination and competition in two-sided markets: Evidence from the Spanish local TV industry. IESE Research Papers D/894, IESE Business School.
- Glazer, A. and Hassin, R. (1982). On the economics of subscriptions. *European Economic Review*, 19(2):343–356.
- Liu, Q. and Serfes, K. (2013). Price Discrimination in Two-Sided Markets. *Journal of Economics & Management Strategy*, 22(4):768–786.
- Morton, F. S. and Oster, S. (2003). Behavioral Decision-Making: An Application to the Setting of Magazine Subscription Prices. Working Paper 10120, National Bureau of Economic Research.
- Petrova, M. (2012). Mass media and special interest groups. *Journal of Economic Behavior & Organization*, 84(1):17–38.
- Resende, M. and Ferioli, E. (2014). Magazine Subscription and Intertemporal Discounting: Some Further Evidence. Technical report.
- Seim, S. and Viard, V. B. (2011). The Effect of Market Structure on Cellular Technology Adoption and Pricing. *American Economic Journal: Microeconomics*, 3(2):221–251.