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The Case of Newspapers

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Estimating market power in a two-sided market: the case of newspapers*

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Abstract

The newspaper industry is a two-sided market: the readers market and the advertising market are closely linked by inter-market network externalities. We estimate market power in the Italian newspaper industry by building a structural model which encompasses a demand estimation for differentiated products on both sides of the market and where profit maximization by the publishing firms takes into account the interactions between them. The question that we address is whether the observed price pattern is consistent with profit-maximizing behavior by competing firms or is instead driven by some form of (tacit or explicit) coordinated practice.

Keywords: *demand estimation, market power, two-sided markets, newspapers, differentiated products.*

JEL codes: L11, L40, L82, C33

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1 Introduction

In the last few years there has been a renewed interest for media markets in economics. With deregulation in the '80s and then globalization in the '90s, we have witnessed a surge in mergers and cross-media ownership, leading to higher media concentration almost everywhere in the world. Whereas other disciplines have dealt with the issue of pluralism and political economy has analyzed political influence on media ownership and media influence in the electoral process, industrial organization and competition policy have been mainly interested in modelling the nature of the various media markets, explaining the economic rationale for concentration and assessing the welfare effects of observed mergers.

One of the key issues is then the extent to which the various media enjoy market power. A model aiming at studying the structure of competition in the newspaper market must take into account the two-sided nature of this market. Indeed, besides the readers market there is also a market for advertising space, and the two are closely linked by inter-market network externalities. In other words, the willingness to pay of advertisers depends on the size (and sometimes on the composition) of the readership, as well as readers demand might be a function also of the amount of advertising. The direction of the former externality is clear-cut: the main reason why advertisers purchase advertising slots is to reach an audience, and therefore the bigger the readership the higher their willingness to pay for them. On the other hand, although advertising volume might have an impact on readers demand for a newspaper, the direction of the network effect that goes from advertising quantities to readers demand is not unambiguously clear: depending on the type of advertising (informative or persuasive), readers may have different perceptions of it, and different degrees of ad-nuisance can well coexist. Therefore we focus on the first type of externality, and leave aside the effect of advertising on readers' demand, which for the class of newspapers we consider in our analysis does not seem to be very strong.

One implication that can be drawn from the growing body of literature on two-sided markets, initiated by Rochet and Tirole (2003, 2004), Caillaud and Jullien (2003) and Armstrong (2004), is that, as pointed out by Evans (2003), in two-sided industries "market definition and market power analyses that focus on a single side will lead to analytical errors". Because of demand interactions between the two sides of the market, the standard markup formula does not hold. In practice, it is usually the case that one side of the market subsidizes the other side, which might end up paying a price below marginal cost. Examples of platforms that do not charge one side are Internet portals, commercial televisions, and the free press.

In order to measure market power, it is then necessary to compute price-cost margins taking into account the two-sided nature of this market. If so, estimating price elasticities of demand is only a first step: in this context, finding a low elasticity of demand would not be enough to conclude that newspapers publishers enjoy a high degree of market power. A profit maximizing publisher selling newspapers has to take into account that it is actually operating in two markets linked by an externality, possibly a two-way one. In general, its optimal

behavior would depend on three different elasticities: the elasticity of demand for daily newspapers with respect to cover price, the elasticity of advertising demand with respect to advertising prices and the elasticity of advertising demand with respect to newspaper circulation. A fourth one might also turn out to be relevant: the elasticity of demand for newspapers with respect to the quantity of advertising on the newspaper. Therefore in order to understand the price structure in this market and to determine the "true" margins, we have to build an empirical model which encompasses a demand estimation of both sides of the market and where profit maximization by the publishing firms takes into account the interactions between them.

Our econometric model consists of two (inter-related) demand equations, one for each side of the market, and one condition for profit maximization. Given that the objective of the paper is to shed light on the pricing strategies and on the competitive structure of this market, we formulate two alternative conjectures, namely that newspaper firms compete in an oligopolistic setting, or that firms jointly maximize profits (in a setting of differentiated products). After estimating the parameters of the demand functions, we then compute the estimated markups under the two alternative hypotheses and then compare them with the observed markup in order to assess which model of competition better explains reality. This strategy is commonly used for market power estimation when data on price-cost margins are available, see for example Nevo (2001).[1]

We perform this analysis on an original dataset which pools together data coming from the Accertamenti Diffusione Stampa (ADS), the Federazione Italiana Editori Giornali (FIEG), Audipress, and additional information that we have collected from other sources.[2] ADS data contain information on newspaper circulation (monthly average daily sales and printed copies). FIEG collects data on accounting balances of publishing firms, in particular information on revenues from sales and advertising and aggregate costs. Survey data on readers' characteristics for each newspaper are published by Audipress. For the purpose of this paper, we use a panel of the four biggest national newspapers in Italy from 1976 to 2003.

There are two main reasons why one may want to perform an empirical study in this market. The first is that despite the growing body of theoretical literature on competition and pricing in two-sided markets, there is still little work on the empirical implications of these theories, especially for media markets. In the next section we discuss some recent contributions that conduct an empirical analysis of the price structure in media markets, but do not explicitly address the issue of market power as we do in our paper.

There is also another reason that makes the Italian newspaper market an

[1] In the absence of information on actual price-cost margins, an alternative way to evaluate which model better fits the data consists of using a Vuong test to select the best specification (see Ivaldi and Verboven, 2003, or Verboven and Brenkers, 2002).

[2] We are grateful to Sibilla Guzzetti of ADS, Laura Ferrari of Audipress, Elena Olivetti of Assocarta and Giovanni Mastrogiacomo of La Stampa for kindly providing us with the data. The data of ADS, Audipress and FIEG are publicly accessible, but only recent years are available on electronic support.

interesting case study. Newspaper cover prices were regulated by a governmental agency, and it is only in 1988 that prices were liberalized. While prices were uniform across newspapers and price changes very rare before the change in the regulation, price liberalization does not seem to have had any strong impact on price competition: prices have had a quite stable pattern and price increases by the different newspapers have always been quite simultaneous. It is therefore interesting in this context to understand what is the pricing policy adopted by newspapers, taking also into account the existence of the related advertising market. In particular, the question that we address is whether the observed pattern in newspaper prices is consistent with profit-maximizing behavior by competing firms or is instead driven by some form of (tacit or explicit) coordinated practice.

After a brief discussion of the existing literature in the next section, in Section 3 we give a general description of the newspaper market in Italy and describe the sample of newspapers on which we carry on our analysis. Section 4 discusses the estimating model. We then provide a general overview of the dataset and justify the choice of variables in Section 5. Section 6 discusses the estimation results and Section 7 concludes.

2 Related literature

This paper is related to the growing body of literature on two-sided markets and in media markets in particular. Recent empirical studies on two-sided markets aim at quantifying network externalities and multi-homing in electronic payments system industries (Ackerberg and Gowrisankaran, 2003; Borzekowski and Kiser, 2003; Rysman, 2004).

Closer to our work are two recent papers by Kaiser (2004) and Kaiser and Wright (2004), who present evidence from the German magazine industry. In the first paper, Kaiser estimates a model for profit maximization of German women magazines and finds that many magazines set prices below marginal costs and that there are significant economies of scale in the production of these magazines, which may justify mergers on efficiency grounds rather than for market power reasons.

Kaiser's approach is very close to ours in that it models both sides of the market and derives a condition for profit-maximization. While readers' demand is estimated in a structural way with a nested logit model, advertising demand is modelled with a behavioral equation for advertising rates: advertising rates are assumed to be a specific function of past circulation following a model of adaptive expectations. Therefore the only choice variable for magazine publishers is cover price, which leads to only one markup formula. This markup formula for cover price differs from the usual markup formula by a term that represents markup deterioration due to advertising. In other words, the markup deterioration term quantifies the effect of a change in cover prices on advertising revenues: an increase in cover price reduces readers' demand, which in turn reduces advertising revenues. This implies that optimal cover price is generally

lower than the one implied by the standard markup formula, and this is due to the link with the advertising market.

This result on the price structure is present also in our model. However, with respect to Kaiser (2004) we model the advertising side in a more structural way, by estimating a (logit) model for advertising demand as well as a model for readers' demand. We have therefore two choice variables (cover prices and advertising prices) and two markup expressions, one for each side of the market.

The paper by Kaiser and Wright (2004) estimates an adapted version of Armstrong (2004) model of competition in a two-sided market where magazines compete in a Hotelling fashion and, similarly to Kaiser (2004) finds that the readers' market is subsidized by advertising. The theoretical model on which the estimation is built applies to a market where there are only two magazine outlets competing in a Hotelling fashion on both markets. Two demand equations are obtained and estimated. The estimated parameters are then plugged into the two first-order conditions for profit maximization. The structure of the price margins resembles very much to Kaiser (2004)'s and ours: equilibrium cover prices are discounted to reflect the externality generated on the advertising side.

Neither Kaiser (2004) nor Kaiser and Wright (2004) explicitly address market power issues, which are instead the focus of our paper. Besides describing and estimating this peculiar price structure, we aim at understanding the implications of the estimated margins for market power. By comparing the estimated margins with the observed ones, we draw inferences about firms' behavior and the strength of competition in this market.

In order to estimate the demand in the two markets, we make use of discrete choice models of product differentiation, which are by now widely used in empirical industrial organization. They all build on the seminal work by McFadden (1973) on discrete choice models, but place particular emphasis on the work with aggregate data, as these are the data most commonly observed in many product markets. In addition, they usually try to link the random utility model at the basis of consumer demand with models of the supply side of the market, mainly models of product differentiation (Anderson et al, 1992). The more frequently used are logit and nested logit. Recently, their limitations have been outlined (Berry, 1994; Nevo, 2000), as they have been found to place restrictive assumptions on patterns of substitution between products and therefore on both marginal effects of price and price elasticities. Thus recent research often uses also the more flexible random coefficients or mixed logit models (e.g. Berry & al, 1995; Nevo, 2001, Petrin, 2002, McFadden and Train, 2000). Such a model is more general and allows substitution between products to depend on product characteristics through observable consumers demographics. However it is not solvable analytically and requires to be estimated by simulation (Nevo, 2000). So that logit or nested logit models not only offer interesting benchmark cases but are still widely used for their computational simplicity or when the implied restrictions on price elasticities and marginal effects are not considered crucial (Brenkers and Verboven, 2002; Kaiser, 2003). As we will argue below, logit and particularly nested logit offer a good analytical tool in our case, as long as

we restrict our analysis to a group of substantially similar products where we can assume without too much bias that substitution takes place on the basis of market shares. Were we to extend the number of newspapers taken into consideration, we would at least need to compare results obtained by a nested logit model with those deriving from mixed logit model.

Interestingly, a recent paper by Kaiser (2003) analyses the market for women's magazines in Germany using a framework very similar to the one we use for readers' demand estimation. His objective is to assess the effect of website provision on magazine circulation. His estimates of price elasticity are not reported but the estimated price coefficient is much higher than ours, which reflects the different nature of the product "women magazine" with respect to the product "daily newspaper". He uses a panel of up to 42 magazines for up to 10 years with yearly observations. As we will see, our data set is much richer. Although we choose a much smaller sample of newspapers, our panel is longer in time and we have monthly observations.

The pioneering works in the analysis of the market for newspapers are, however, those by Corden (1952) and Reddaway (1963) who first recognized and modelled the existence of externalities between circulation and advertising. More recently Bucklin, Caves and Lo (1989) modelled the incentives towards monopolization due to the particular features of a circulation industry and presented supporting econometric evidence from the US market. The estimated price elasticity in their model is of the same order of magnitude than our estimates. Blair and Romano (1993) also analyzed the market in question as a circulation industry and identified the issues arising in estimating price elasticities in a circulation industry if its nature is not recognized. Chaudri (1998) considers instead the market for newspapers as a dual market and analyses all the three benchmark cases of monopoly, oligopoly and perfect competition, in both the advertising and the newspapers market, deriving interesting results on the relative efficiency of these market structures, both when compared to each other and to those of a non dual market. Häckner and Nyberg (2001) endogenize market structure as determined by strategic interaction in the interrelated markets of newspapers and advertising, whereas Gabszewicz et al. (2003) show that, in a duopoly framework, readers feeling about advertising on the newspapers influences price competition between newspaper publishers selling in the two markets.

3 Daily newspapers in Italy

The Italian market for daily newspapers is quite a rich one. It is mainly composed of quality newspapers though many of them are quite politically oriented, if not directly owned by political parties or members of political parties. Tabloids are in practice inexistent in the daily market and free daily newspapers appeared only in 2000.

Although an exact market definition is not the subject of this paper, we can roughly identify, by content, the following traditional categories of daily

newspapers: a) newspapers of general information; b) financial, business and economic newspapers; c) sport newspapers. A further distinction has always been, of course, the one between local and national newspapers, with local newspapers being quite a lot in number and enjoying a substantial share of overall readers.[3] [4]

It should be noticed however that both these classifications are by no means set once and for all. Some national newspapers were born with a strong regional or even local characterization. Many of them have been adding local pages through the years. Others chose agreements with local newspapers which allowed the two to be sold together at a lower price. Furthermore there has been a growing trend for newspapers of general information toward including business and sport sections.

We carry out our analysis on the four main national generalist newspapers which are commonly believed to be best substitutes to each other, namely *Corriere della Sera*, *La Repubblica*, *La Stampa* and *Il Giornale*.[5] Together with *L'Avvenire*, *Il Giorno* and *Il Foglio* they belong, according to FIEG, to the group of national daily newspapers. In 2000 they alone accounted for more than 90% of the sales of the group, while the group itself accounted for 35% of overall sales of daily newspapers.

The series of monthly average daily printed copies for the four newspapers considered are presented in Figure 1 in the Appendix. The two leading ones in terms of circulation are *Repubblica* and *Corriere della Sera*, while *La Stampa* has a lower market share and *Il Giornale* is well below *La Stampa*. Corriere della Sera, founded in 1876, is, in the last few years, the one that sells more copies, fiercely competing with *Repubblica*, while *La Stampa*, which being founded in 1867 is the oldest, and has consistently lower sales in the period considered here. It should also be taken into account that La Repubblica was born exactly in January 1976. As a result the graph of its average daily sales follows the usual S-shape well-known in the literature on product diffusion. Looking at the graphs it is also possible to notice that a strong monthly seasonality affects the data. The timing of the spikes which can be observed in Figure 1 in January 1989 for *Corriere della Sera* and in January 1987 for *Repubblica* coincide respectively with *Portfolio* and *Replay*, two games of the lotto kind which could be played only and simply by buying a copy of the newspaper (at the normal price).

A particular feature of the Italian newspaper market has always been the weak price competition. For many years the price was regulated, and even after price liberalization nominal price changes have been very rare and quite simultaneous across newspapers (see Figure 2 in the Appendix).

[3] This is the classifiation adopted by the Italian competition authority in several occasions (see for example the case 3354/95 *Ballarino vs. Grandi Quotidiani*).

[4] For a discussion on market definition in printed media industries, see also Argentesi and Ivaldi (2005).

[5] Other national newspapers which were or are politically-oriented (controlled directly or indirectly by political parties) had in the past periods of very high circulation (e.g. *L'Unità*, the newspaper of the left-wing party). Unfortunately, the political newspapers are not present (at least not continuosly) in the ADS database.

Only through bundling a certain degree of price competition has been introduced and a limited variability of prices across newspapers has appeared. Starting from the end of the Eighties, the practice of selling supplements and inserts together with newspapers has become increasingly widespread.[6] Although most bundling leaves the consumer free to buy the newspaper alone or together with the bundle product (mixed bundling), so that the choice can be conceived as that for two different products, in the case of some supplements the reader is forced to buy the supplement if he wants to read the newspaper and thus forced to pay the higher price for the bundle and vice versa (pure bundling).[7] The choice is then the choice for a single product with different characteristics. Given that each newspaper bundles the weekly magazine with the newspaper in a different weekday, this practice introduces a source of variability in prices across newspapers and weekdays which, as argued below, can be exploited to estimate the price elasticity of demand for daily newspapers in Italy.

The series of advertising volumes and nominal prices for the newspapers considered are plotted in Figure 3 and 4 respectively (see Appendix).

4 A "supply-and-demand" model

In this section we develop and estimate a model that captures the interaction between the two sides of the market, namely the readers and the advertisers. In particular, we estimate two demand models, one for the readers' side and one for the advertising side together with a model of the supply side. On the supply side, newspaper publishers are assumed to maximize their profits on both markets. We derive the pricing equation under two alternative assumptions, namely that the market is (oligopolistically) competitive and that firms jointly maximize their profits,[8] and then compare the estimated margins with a crude measure of observed margins in order to determine what is the "true" model. This allows us to explore the issue of market power which has not been addressed in previous papers on printed media industries.

4.1 The demand side

Since the demand is two-sided, we need to specify and estimate two demand models, one for the advertising market and one for newspaper circulation.

We focus on the impact that circulation has on advertising demand rather than on the impact of advertising quantities on readers' demand. To simplify things, we assume therefore that readers' demand is independent of advertising. We believe this is a plausible approximation of reality since readers may have different perceptions of advertising depending on the content (informative or

[6] For an analysis of the impact of weekly supplements on newspaper circulation, see Argentesi (2004).

[7] This is the case of weekly magazines, which are bundled with the newspaper in a particular weekday (different for each newspaper).

[8] In the following of the paper the word "collusion" is used as a synonym of joint profit maximization.

persuasive), and different degrees of ad-nuisance can well coexist. Especially for printed media, readers' attitude towards advertising is not clear-cut: the general ad-aversion that may apply to other media might be mitigated by the fact that advertising on newspapers can be skipped more easily than for example on television, and classified advertising is more widespread. The assumption that advertising does not have an impact on readers' demand is also consistent with Kaiser and Wright (2004)'s findings on the magazine market, which show a very low significance of advertising shares in the equation for readers' demand.

We assume therefore that the demand for advertising space is a function of the size of the readership, whereas the demand for newspapers is independent of advertising. In other words, we consider newspaper circulation as a complement good with respect to advertising: other things being equal, when the price of a newspaper increases, its readership decreases and therefore advertising demand decreases as well.

4.1.1 Newspaper demand

We estimate a logit model of demand for differentiated products using the panel data on the average daily number of copies printed in each weekday of each month for *Repubblica*, *Il Corriere della Sera*, *La Stampa,* and *Il Giornale*.

The utility of consumer j from purchasing newspaper i at time t is a function of the newspaper's observed and unobserved characteristics ($\mathbf{x}_{it}^N$ and ξ_{it}^N respectively), cover price (p_{it}^N), and unknown parameters. The following functional form is assumed:

$$u_{ijt} = \mathbf{x}_{it}^N \boldsymbol{\beta}^N - \alpha^N p_{it}^N + \xi_{it}^N + \epsilon_{ijt} \tag{1}$$

where ϵ_{ijt} is an i.i.d. extreme-value distributed error term.

Given the panel structure of data, the unobservable component ξ_{it}^N can be decomposed as

$$\xi_{it}^N = \gamma_i + \varepsilon_{it} \tag{2}$$

where γ_i is a newspaper-specific component and ε_{it} is an i.i.d. error term varying across newspapers and time. The newspaper-specific component γ_i is assumed to be an unknown parameter specific to each newspaper, which leads to a fixed-effect model.

Consumers are assumed to purchase one unit of the good that gives them the highest utility.[9] Consumer mean utility δ_{it} from consumption of good i at time t is

$$\delta_{it} = \mathbf{x}_{it}^N \boldsymbol{\beta}^N - \alpha^N p_{it}^N + \xi_{it}^N \tag{3}$$

[9] The implicit assumption, common to most empirical studies on differentiated product markets, is that consumers purchase at most one product. This assumption seems reasonable in the case of newspapers, where multiple purchases are likely to be negligible, especially if the unit of analysis is the individual and not the household, as is the case here. Moreover, subscriptions and corporate purchases of newspapers, which are typically multiple purchases, are very low in Italy.

The logit model leads to the following form of market share for newspaper i at time t (choice probability):

$$s_{it}^N(\delta_{it}) = \frac{\exp(\delta_{it})}{1 + \sum_{k \neq 0} \exp(\delta_{kt})} \tag{4}$$

where s_{it}^N is the number of copies printed by newspaper i at time t relative to the total market size. Market size is defined as the total population in Italy older than 14 years at time t.

The specification of the demand system is completed with the introduction of an outside good, whose utility is generally normalized to zero, so that the market share for the outside good is

$$s_{0t}(\delta_{it}) = \frac{1}{1 + \sum_{k \neq 0} \exp(\delta_{kt})} \tag{5}$$

The estimation equation for the market share of newspaper i at time t is obtained by taking logarithms and subtracting the log of the market share of the outside good from the log of the market share of each newspaper, i.e.:

$$\begin{aligned} \ln(s_{it}^N) - \ln(s_{0t}^N) &\equiv \ln\left(\frac{\exp(\delta_{it})}{1 + \sum_{k \neq 0} \exp(\delta_{kt})}\right) - \ln\left(\frac{1}{1 + \sum_{k \neq 0} \exp(\delta_{kt})}\right) = \\ &= \delta_{it} = \mathbf{x}_{it}^N \boldsymbol{\beta}^N - \alpha^N p_{it}^N + \xi_{it}^N \end{aligned} \tag{6}$$

The dependent variable is therefore the (log) market share of newspaper i at time t relative to the market share of the outside good, which is calculated as $s_{0t} = 1 - \sum_i s_{it}$.

4.1.2 Advertising demand

Similarly to readers' demand, we choose to adopt a logit specification also for advertising demand. The assumptions behind the logit model might be stronger in this context than they are in the context of readers' demand. In particular the assumption of single purchase could be more problematic when referred to the purchase of advertising space than when it refers to readers' choice, because there might be advertisers who buy slots in more than one newspaper. However, the alternative to the structural approach is a reduced-form approach, which suffers from other drawbacks. For example, the solution proposed by Kaiser (2004) is to model the advertising side with a behavioral equation, whereby advertising rates are a function of past circulation. This methodology has the implication that the link between the two sides of the market is only intertemporal, and therefore the newspaper firms has only one decision variable, i.e. cover price (and not two as in our model). Therefore we decided to maintain the logit assumption.

Adopting a logit specification also for the demand of advertising slots, the estimating equation for the advertising market is

$$\ln(s_{it}^A) - \ln(s_{0t}^A) = \mathbf{x}_{it}^A \boldsymbol{\beta}^A - \alpha^A p_{it}^A + \xi_{it}^A + \rho y_{it}^N \tag{7}$$

where s_{it}^A is the number of advertising slots of newspaper i at time t relative to the total market size. Total market size for advertising is defined as the market of daily publications.

The model takes into account the fact that the demand of advertising space depends positively on the circulation of the newspaper y_{it}^N, which in turn depends on the vector of newspaper prices.

Recall that from the properties of the logit model it follows that:

$$\frac{\partial s_{it}^N}{\partial p_{it}^N} = -\alpha^N s_{it}^N (1 - s_{it}^N) \tag{8}$$

$$\frac{\partial s_{it}^A}{\partial p_{it}^A} = -\alpha^A s_{it}^A (1 - s_{it}^A) \tag{9}$$

$$\frac{\partial s_{it}^N}{\partial p_{kt}^N} = \alpha^N s_{it}^N s_{kt}^N \tag{10}$$

$$\frac{\partial s_{it}^A}{\partial p_{kt}^A} = \alpha^A s_{it}^A s_{kt}^A \tag{11}$$

$$\frac{\partial s_{it}^A}{\partial y_{it}^N} = \rho s_{it}^A (1 - s_{it}^A) \tag{12}$$

$$\frac{\partial s_{it}^A}{\partial y_{kt}^N} = -\rho s_{it}^A s_{kt}^A \tag{13}$$

4.2 The supply side

We assume that newspapers are price setters in both markets. We shall consider two different scenarios, one in which the industry is (oligopolistically) competitive, and one in which it is collusive (joint profit maximization). We derive the pricing equations under the two hypotheses and the corresponding formulas for the markups. We then substitute the estimated demand parameters in the markup formulas. In this way we obtain four estimated markups: one corresponding to a situation of oligopolistic competition in both markets, one for joint profit maximization in both markets, and two for the intermediate cases (competition on the newspaper market and joint profit maximization in the advertising market; competition on the advertising market and joint profit maximization in the newspaper market). We can then compare the estimated margins with the empirical margins in order to assess which is the right model as in Nevo (2001).

4.2.1 Oligopolistic competition

We derive the pricing equation under the hypothesis that newspapers are competing à la Bertrand-Nash. Since the newspapers offered are differentiated, we are in a framework of oligopolistic competition.

The profit function of each newspaper i is[10]

$$\pi_i(p_i^A, p_i^N) = p_i^N y_i^N(\mathbf{p}^N) + p_i^A y_i^A(\mathbf{p}^A, \mathbf{y}^N(\mathbf{p}^N)) - C_i(y_i^N(.), y_i^A(.)) \qquad (14)$$

where p_i^N is the price of newspaper i, y_i^N is its demand, which depends on the vector of newspapers prices $\mathbf{p}^N$. As to advertising revenues, p_i^A is the price of an advertising slot on newspaper i, and y_i^A is the corresponding demand, which depends on the vector of advertising prices $\mathbf{p}^A$ and on the vector of readers' demands (which in turn depend on newspaper prices).

It is not possible from newspapers budgets to distinguish between costs of newspapers and costs of advertising. There are probably fixed costs related to the decision to advertise, for instance costs to print in color, but printing an article or an advertising has probably the same cost. There might be an advertising cost to consumers but we assumed there is no externality and also in newspapers we might expect that also if advertising has a negative impact on consumers it is less relevant than on other media such as television.

Each firm chooses the prices for advertising and the newspaper which maximize profits, taking other firms' behavior as given. For each newspaper i, there are two FOCs, one which determines the pricing equation for advertising and one which determines the pricing equation for the newspaper:

FOC(p^A)

$$(p_i^A - c_i^A)\frac{\partial y_i^A}{\partial p_i^A} + y_i^A = 0, \forall i$$

Recalling (9), this equation can be rewritten as

$$p_i^A - c_i^A = -\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} = \frac{1}{\alpha_A(1 - s_i^A)} \qquad (15)$$

FOC(p^N) The FOC with respect to p^N is different because it incorporates the fact that the choice of the price of a newspaper has an impact not only on the readership, but also on advertising revenues.

The maximization with respect to p^N gives therefore

$$(p_i^N - c_i^N)\frac{\partial y_i^N}{\partial p_i^N} + y_i^N + (p_i^A - c_i^A)\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} = 0, \forall i, j$$

Recalling equations (8) - (13), this expression can be transformed into

$$\begin{aligned} p_i^N - c_i^N &= -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A)\frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_{j\neq i}\frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} = \\ &= \frac{1}{\alpha^N(1 - s_i^N)} - (p_i^A - c_i^A)\rho s_i^A(1 - s_i^A)A + \\ &\quad -\frac{(p_i^A - c_i^A)}{1 - s_i^N}\sum_{j\neq i}\rho s_i^A s_j^A s_j^N A \end{aligned} \qquad (16)$$

[10] In what follows, we omit the t subscript to simpify notation.

Notice that the price-cost margin is lower than in the standard case exactly because of the inter-market network effect: a change in cover price has an effect on advertising revenues. This network effect is represented by the two negative terms in the right-hand side of equation (16).[11] The first negative term expresses the fact that a price increase decreases own readership and therefore decreases own advertising demand. The last term in the right-hand side of equation (16) represents instead the effect through competitors: a price increase for newspaper i increases the readership of rival newspapers, and has a negative effect on its advertising demand through an impact on rivals' advertising demand.

4.2.2 Joint profit maximization

Suppose now that firms collude (or jointly maximize profits). Each firm i chooses the prices which maximize joint profits:

$$\Pi(p_i^A, p_i^N) = \sum_i \left[p_i^N y_i^N(\mathbf{p}^N) + p_i^A y_i^A(\mathbf{p}^A, \mathbf{y}^N(\mathbf{p}^N)) - C_i(y_i^N(.), y_i^A(.)) - F_i\right]$$

As in the case of competition, we derive the FOCs for each of the two prices.

FOC(p^A)

$$(p_i^A - c_i^A)\frac{\partial y_i^A}{\partial p_i^A} + y_i^A + \sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A} = 0, \forall i$$

The FOC can be rewritten as

$$p_i^A - c_i^A = -\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \sum_{j\neq i}\frac{(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}} = \frac{1}{\alpha^A(1-s_i^A)} + \frac{\sum_{j\neq i}(p_j^A - c_j^A)s_j^A}{1-s_i^A} \tag{17}$$

The additional term on the right-hand side of equation (17) represents the fact that under collusion, firm i takes into account the impact that her decisions have on other firms' profits, and therefore the price she sets is higher than the one under competition.

FOC(p^N) The maximization with respect to p^N gives instead

$$(p_i^N - c_i^N)\frac{\partial y_i^N}{\partial p_i^N} + y_i^N + (p_i^A - c_i^A)\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \sum_{j\neq i}\left[(p_j^N - c_j^N)\frac{\partial y_j^N}{\partial p_i^N} + (p_j^A - c_j^A)\sum_k \frac{\partial y_j^A}{\partial y_k^N}\frac{\partial y_k^N}{\partial p_i^N}\right] = 0, \forall i$$

[11] This term has the same interpretation of the "markup deterioration term" described by Kaiser (2004).

Recalling (8) - (13), this equation can be transformed into

$$p_i^N - c_i^N = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A)\frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}} \sum_{j \neq i} \frac{\partial y_i^A}{\partial y_j^N} \frac{\partial y_j^N}{\partial p_i^N} +$$
$$- \sum_{j \neq i} \left[\frac{(p_j^N - c_j^N)\frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}} + \frac{(p_j^A - c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}} \sum_k \frac{\partial y_j^A}{\partial y_k^N} \frac{\partial y_k^N}{\partial p_i^N} \right]$$
$$= \frac{1}{\alpha^N (1 - s_i^N)} - (p_i^A - c_i^A)\rho s_i^A (1 - s_i^A) A - \frac{(p_i^A - c_i^A)}{1 - s_i^N} \sum_{j \neq i} \rho s_i^A s_j^A s_j^N A +$$
$$+ \sum_{j \neq i} \left[\frac{(p_j^N - c_j^N) s_j^N}{1 - s_i^N} - (p_j^A - c_j^A)\rho s_j^A (1 - s_j^A) A - \frac{(p_j^A - c_j^A)}{1 - s_i^N} \sum_{k \neq j} \rho s_j^A s_k^A s_k^N A \right] \tag{18}$$

This expression differs from (16) by the last term, which represents the higher markup due to joint profit maximization. Notice that also this last effect is mitigated by the existence of a link with the other side of the market, and therefore the markup is lower than in the standard collusive case.

5 The data

Our database on the market for newspapers in Italy mainly draws from the data collected every year, from 1976 onwards, by the Accertamenti Diffusione Stampa (ADS), which cover most national and local newspapers. ADS certifies the validity of this information for advertising purposes. Newspapers are free to choose whether to have their data certified or not, but if they choose so they are obliged to provide all the information required and the truthfulness of the reported information can be verified by the ADS. Most of the Italian newspapers chose certification, some of them did not, or at least did so only discontinuously. All in all, however, the data collected by ADS provide quite a complete picture of the dynamics of the market in question for the last 27 years. The information available for each newspaper includes, at various levels of time disaggregation, data on sales, prints, gift copies, free subscriptions and paid subscriptions.

We restrict our analysis to the national newspapers of general information. As motivated above, this market seems to be distinguishable both from the market of business newspapers and from that of sport newspapers. Moreover, the national newspapers of general information seem to belong to a different market than local newspapers, which mainly cover local news and are therefore targeted to a different kind of readership.

The database drawn from ADS files has been completed with other useful information, mainly obtained from newspaper publishers, such as the nominal prices of the newspapers, the dates regular supplements were first enclosed, the

list of all promotions with the corresponding periods, the changes of editors, and the dates of the opening of the newspapers web-sites.

In order to estimate a model of demand for daily newspapers, our first choice would have been, of course, to use the average number of copies sold in Italy in each month by newspapers agents or the number of paying subscriptions. However, given our aim to estimate the price elasticity of demand and the already discussed low variability of prices across newspapers, in the attempt to enjoy a higher disaggregation of the data we chose to estimate a model of the market by using data on average daily prints for each different weekday in each month. By doing so we could exploit the higher variation in the data, particularly the variation in prices across weekdays within the same newspaper, due to the presence of a supplement.

As to the data on advertising, we have information on yearly average advertising quantity and revenues from 1992 to 2003 across all the daily newspapers and across all the print market (newspapers and magazines). Besides these aggregate data, we also have yearly data on advertising revenues for each daily newspaper from 1988 to 2003.

As to advertising rates, we have the price list for different types of advertising slots for each of the four newspapers considered. These data are currently available from 1990 to 2003. We are aware of the limitations of using price list data in a field where discounts are a common practice, but this was the only information we managed to obtain.[12] Moreover, what matters for the sake of the present analysis is that the potential bias between price list and actual prices does not differ too much across newspapers, which seems a plausible assumption.

In order to perform the estimation of the demand for advertising, we need information on the advertising price and on advertising quantity for each newspaper. The former information is contained in the price lists, whereas yearly average advertising volumes are calculated using this information together with individual advertising revenues.[13] The assumption that allow us to derive advertising quantities is that discount policies do not vary too much across newspapers and over time.

We then use average advertising quantity across all the daily newspapers to recover the share of the outside option, and we use it also to compute the average advertising rate across all the daily newspapers (together with the information on average advertising revenues).[14]

Another type of information that we use to estimate the demand for advertising is readership characteristics.[15] For each newspaper, we include in the

[12] In fact, also price lists were not easy to obtain, because they are no longer published by newspapers (we obtained them from a private source).

[13] In particular, advertising volumes are computed dividing advertising revenues by advertising prices for each newspaper. This amounts to assuming that advertising discounts, if any, are a percentage of the price.

[14] Alternatively, one could define the total potential market as the one for daily and non-daily publications instead of the market for daily papers only, but the latter definition seems more consistent with the predominant approach to market definition. See Argentesi and Ivaldi (2004) for a discussion of market definition in printed media industries.

[15] These data are available upon request from Audipress, an association which collects in-

regression a variable for the proportion of male readers and a variable for average age of the readership for each newspaper.

Results for the two demand equations and for markup estimation are presented in the next section.

6 Estimation

In order to fully estimate the model described above, we have to estimate two demand models, one for the advertising market and one for the circulation market. We then use the estimated parameters to compute the price-cost margins under the hypotheses of competition and collusion and then compare them with the observed margins in order to assess which is the right model.

In order to estimate the markups, we need to estimate elasticities of readers' demand and advertising demand. We estimate both demand equations under a multinomial logit specification.

We estimate a logit model for readers' demand on a panel of the four major newspapers of general information with monthly observation by weekday from 1976 to 2001. The vector of product characteristics includes dummies for the issue of the weekly magazines that are sold together with the newspaper (both a dummy for the weekday of issue and a dummy for their introduction which is meant to capture a spillover effect[16]), dummies for the launch of websites, a dummy for the games with prizes, the changes of editors, the issue of the Monday edition, and dummies for other events like elections, sport events, and months in order to deseasonalize the data. We also add a time trend in order to control for a possible trend of growth of the whole market, or a general shift in consumer tastes.

The residuals seem to be serially correlated, therefore we estimate a fixed effect logit model with Newey-West standard errors. Therefore the error structure is assumed to be heteroskedastic and possibly autocorrelated up to 12 lags (12 months).

Given that the data are monthly average printed copies by weekday for each newspaper, the fixed effect is a newspaper-weekday fixed effect rather that a newspaper fixed effect. This allows for a different ranking of newspapers across weekdays, which is very convenient when considering the impact of magazines that are issued in different days of the week by different newspapers.[17]

Given the particular features of the daily newspapers market in Italy, which, as further discussed below, has always been characterized by weak price competition, we observe price variability across newspapers only in the presence of supplements Identification of the price effect is then obtained by controlling for

formation on readership characteristics on the Italian printed media industry.

[16] The spillover effect is the effect of the introduction of supplements on other weekdays as well.

[17] Notice that the vector of fixed effects ξ is identified separately from the coefficients on characteristics because in our framework the latter are time-variant (see Berry, 1994 p. 256 and Kaiser, 2003).

the inclusion of the supplement, under the simple assumption that its quality does not change over time.

Notice that price endogeneity is not a big concern in this framework because prices were regulated until the end of the Eighties and even afterwards there was not much variability in nominal prices across newspapers and over time, so we can reasonably assume that prices are at least predetermined.

The estimation results for readers' demand are presented in Table 1 in the Appendix.

The price coefficient is negative: estimated own elasticities are around 0.48.[18] Cross elasticities are estimated in a range from 0.008 (*Corriere della Sera*) to 0.002 (*Il Giornale*). These estimates of elasticities are consistent with previous studies: for example, Bucklin, Caves and Lo (1989) estimate own elasticities which range from 0.26 to 0.55, whereas Dertouzos and Trautman (1990)'s estimates are around 0.44.

The other coefficients have the expected sign and are very precisely estimated. The coefficient for the day of issue of the magazine of general information is positive and strongly significant. The fact that the coefficient of the dummy for the introduction of the magazine of general information is positive and significant in both regressions suggests that the supplements had an impact not only on the day of the week in which they are issued, but also on the other days, which can be seen as a spillover effect. Our estimates show that lottery games that were introduced by some newspapers in the Nineties seem to have been very successful. Another interesting result concerns the launch of websites, which seems to have a negative impact on printed newspapers.[19] This result contrasts with those of Kaiser (2003), who finds that there is no significant crowding out by the online version in the German market for women magazines. This difference can partly be explained with the fact that in Italy the online version was very similar to the printed one, which was not the case for German women magazines. Our findings can also explain the fact that, after a period where the online version was free-of-charge, some newspapers (namely those whose websites were more successful) started to charge readers for online access to full content.

We estimate the demand for advertising space under the specification discussed at the end of the last section. We estimate advertising demand on a panel of newspaper with annual data from 1992 to 2003. As explanatory variables for advertising demand we include advertising rates, newspaper's sales, the readers' average age and the share of male readers. There is a potential endogeneity problem to be discussed, concerning both newspaper circulation and advertising rates. Given our claim that cover prices are exogenous (or at least predetermined) in the readers' demand equation, then the size of the readership should not be endogenous in the advertising demand equation. However, advertising rates are likely to be endogenously determined, and should therefore be instrumented. We use the (average) characteristics of other firms as

[18] Elasticity estimates are presented in Table 2 in the Appendix.

[19] Filistrucchi (2003) analyses the impact of website provision on printed newspapers on the same dataset that we use here.

instruments, as it is commonly done in previous work on discrete-choice models of product differentiation.[20] These are appropriate instruments because they are correlated with price through the condition for profit maximization, but are assumed to be exogenous to the single firm decision.[21]

Results of this estimation are shown in Table 3. The price parameter is negative and significant, albeit very small. Newspaper circulation is positive, which confirms the existing link with the readers market. The demand for advertising space seems to be negatively correlated with readers' age and with the share of male readers.

Results for the estimated markups are reported in Table 4. The figures in Table 4 are average (from 1997 to 2001) markups on advertising rates and on cover prices under the four alternative hypotheses of competition: (oligopolistic competition) in both markets, joint profit maximization in both markets, competition on the newspaper market but joint profit maximization in the advertising market, and competition on the advertising market but joint profit maximization in the newspaper market. Both cover price markup and advertising price markup are reported. Total markup is the sum of the two markups (where advertising markup has been transformed in per copy terms rather than per advertising slot).[22]

An interesting feature of the estimated markups is that, given our observed quantities, joint profit maximization in the advertising market seems to give a lower total markup than oligopolistic competition. In Appendix B we derive the conditions under which this situation may arise. This feature is another consequence of the two-sided nature of this market. To give the intuition of why this situation can arise, let us consider the case where there is competition in the readers' market[23] and compare the total markup under the two alternative hypotheses on the advertising market, namely competition and collusion, *for a given level of prices and quantities*.[24] In this situation, if firms were colluding in the advertising market, advertising prices will be higher than if firms were competing. This in turn means that advertising quantity will tend to be lower. Given the link between the two sides of the market, in order to keep advertising quantity unaltered the firm can increase the readership (which has the offsetting effect of raising the advertising quantity). But this can be done only by lowering cover price, which implies a lower markup on the cover price. If the lower

[20] See for example Berry (1994) and Nevo (2001).

[21] We have also tried to use other possible instruments for advertising prices like the wholesale price of paper and the number of complimentary copies distributed by each newspapers (which could be seen as a cost of attracting advertising and therefore correlated with advertising price). However these alternative instruments do not seem to perform very well.

[22] Notice that there are only two relevant markups for advertising rates (one for the competitive case and one for the collusive case) because advertising markups do not depend on cover price given our assumption that the externality is one-sided. We have instead four relevant cover price markups because these markups depend on the advertising market.

[23] As we show in Appendix B, the same logic applies to the case where there is collusion in the readers' market.

[24] This qualification is important because we are not saying that collusion always gives a lower markup than competition, but rather that, *given the observed quantity levels*, the firm would get higher profits in a competitive situation than in a collusive one.

cover price markup more than offsets the higher advertising price markup (with respect to the case of competition in advertising), then the total markup under collusion (in advertising) is lower than the total markup under competition (in advertising).[25] The intuition lies therefore in the network effect that links the two sides of the market, and in particular on the impact that advertising has on cover price markup.

From the balance data that we have, we have computed the (average) total markup per copy for the category of newspapers that we are considering, which is 0.943 Euro. We compare this observed markup with the estimated ones in order to assess which model of competition better fits reality. Given that in the advertising market joint profit maximization is dominated by competition for the reason explained above, the two relevant estimated markups are the first one (competition in both markets) and the third one (joint profit maximization in the newspaper market and competition in the advertising market) in Table 4 (in bold in the table). The observed markup falls within the 90% confidence interval (computed by bootstrap)[26] of the estimated markup that firms would obtain if they were jointly maximizing profits in the newspaper market, whereas it falls out of the confidence interval of the estimated markup under competition in the newspaper market. This seems to show that the hypothesis that there exist some collusion cannot be rejected by the data. Indeed our results suggest that there might be some collusion on cover price and a competitive behavior on the advertising side. This seems to be consistent with the pattern of cover prices and with the impression that newspapers are not competing so much along the price dimension. On the other hand, the advertising market seems to be much more competitive due also to the competitive pressure from other media. Indeed, advertising rates are subject to a lot of discounting and are not easily observable by competitors, a factor which probably makes collusion more difficult to sustain.

7 Conclusions

We address the issue of measuring market power in a two-sided market with an application to the Italian newspaper market. Using an original dataset on Italian newspapers, we estimate the demand on the two sides of this market, namely the readers' side and the advertising side. We also model the supply side and derive the hypothetical markups under two alternative conjectures about newspapers' behavior, namely a competitive behavior and a collusive behavior. The comparison between the estimated markups and the observed markups shows some evidence of joint profit maximization on the newspaper cover price, whereas the advertising market is closer to competition, which is consistent with

[25] The explicit condition under which this is the case is derived in Appendix B and essentially depends on the magnitude of the network effect and on the price sensitivity of newspaper demand.

[26] The confidence intervals are computed with the normal, the bias-corrected, and the percentile methods.

anecdotical evidence.

One possible direction for further research could be to extend the theoretical model in order to account for the possibility of a two-sided externality, namely when readers care about advertising. This would also allow us to estimate readers' taste for advertising, which is something that has received little attention in the empirical literature. Since this type of analysis would require a simultaneous estimation of the two demand systems, it would probably be hard to implement it with our current dataset, because we only have yearly data available for the advertising market whereas we have monthly data for on the readers' side. Therefore this exercise would require a larger dataset on advertising demand.

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8 Appendix A: Tables and figures

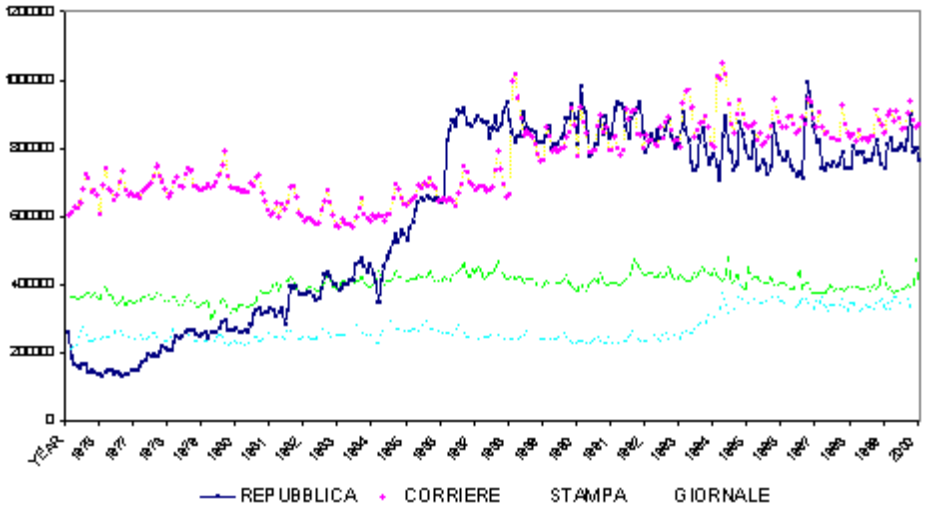

Figure 1: Monthly averages of daily printed copies

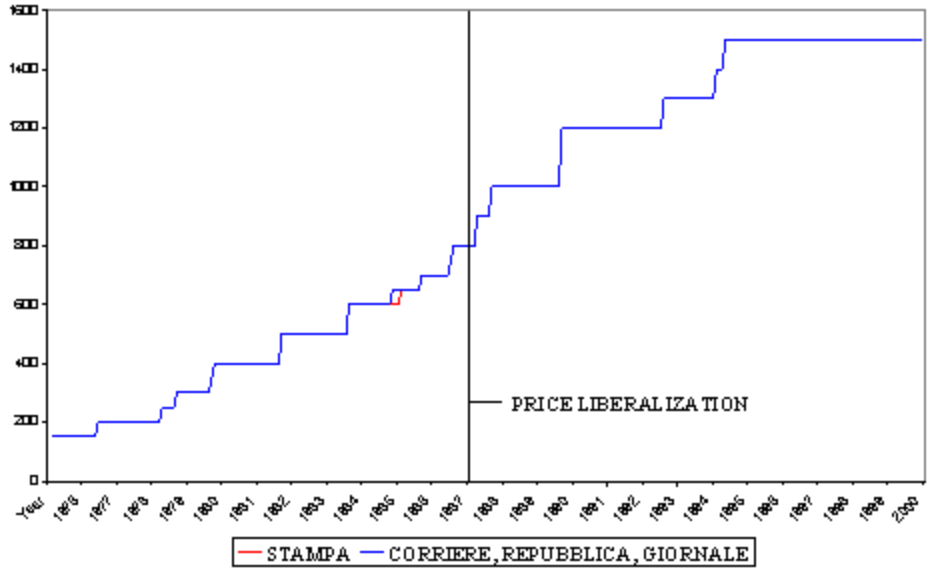

Figure 2: Newspapers' cover prices (in ITL)

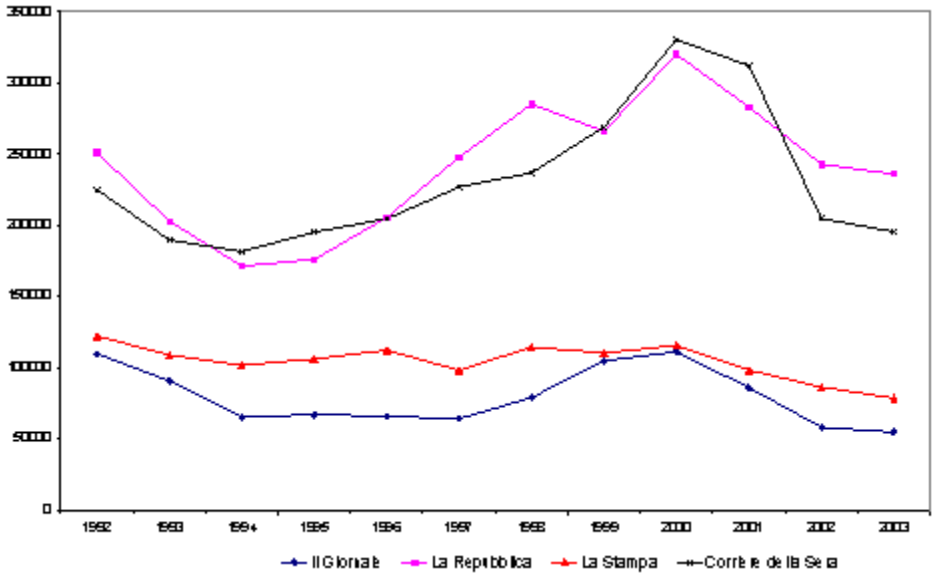

Figure 3: Advertising volumes.

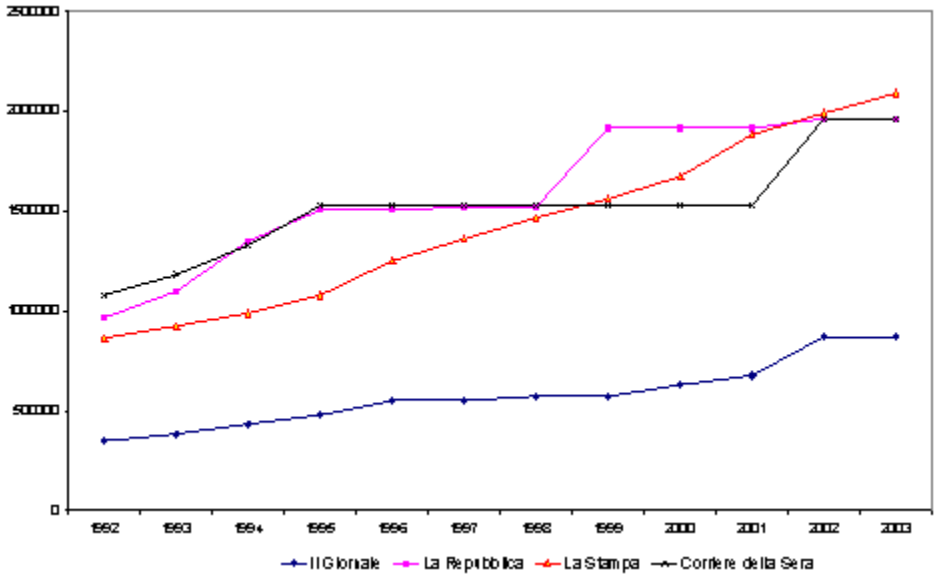

Figure 4: Nominal prices per advertising slot (in ITL).

Table 1: Readers' demand

	Logit fixed effects
Real cover price	- 0.0004***
	(0.000)
Own supplement (day)	0.360***
	(0.015)
Own supplement	0.506***
	(0.010)
Own women supplement (day)	0.243***
	(0.019)
Own women supplement	0.030*
	(0.017)
Games with prizes	0.184***
	(0.009)
Website	- 0.070***
	(0.014)
Time trend	Yes
Constant	- 3.506
N. of obs.	8417
N. of groups	28

Note: The dependent variable is log market shares of circulation (see equations (6)). Standard errors are in parentheses. Other control variables are included in the regression, such as dummies for sport events, elections, change of editors etc.

Table 2: Own and cross demand elasticities for readers' demand

	Corriere	*Repubblica*	*Stampa*	*Giornale*
Corriere	-0.4855	0.0082	0.0082	0.0082
Repubblica	0.0070	-0.4919	0.0070	0.0070
Stampa	0.0054	0.0054	-0.4734	0.0054
Giornale	0.0028	0.0028	0.0028	-0.4712

Table 3: Advertising demand (IV Logit)

	Coefficient	Standard error
Advertising rates	-7.19e-07***	1.18e-07
Newspaper's sales	2.57e-06***	2.30e-07
Male readers	-.0552***	.0121
Readers' age	-.0966***	.0151
Constant	.7347	
N. of obs	44	

Note: The dependent variable is log market shares of advertising for each newspaper (see equation (7)). Instrumental variable: sum of other newspapers' characteristics.

Table 4: Estimated markups

	Advertising markup	Cover price markup	Est. markup (total)
Comp(N)-Comp(A)	**.603**	**.226**	**.829 (.062)**
Comp(N)-Coll(A)	.611	.210	.822 (.062)
Coll(N)-Comp(A)	**.603**	**.293**	**.896 (.065)**
Coll(N)-Coll(A)	.611	.278	.889 (.065)

Note: Markups are expressed in Euro. "Comp (N)-Coll(A)" indicates the case where the newspaper market is competitive and the advertising market is collusive, and similarly for the other cases. Bootstrapped standard errors are in parentheses.

9 Appendix B: Comparison of markups

9.1 Case competition-collusion vs competition-competition

We want to explore the conditions under which, given the observed prices and quantities, joint profit maximization in the advertising market might give a lower (total) markup than oligopolistic competition. We then compare the markup obtained in the case where there is competition in the readers' market and collusion in the advertising market with the markup obtained under competition in both markets, *for a given level of prices and quantities*.

9.1.1 Markup competition-collusion

We write the total markup in the case where firms compete in the readers' market but collude in the advertising market.

1. Readers market (recall eq. (16)

$$p_i^N - c_i^N = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A)\frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}} \sum_{j \neq i} \frac{\partial y_i^A}{\partial y_j^N} \frac{\partial y_j^N}{\partial p_i^N} \qquad (19)$$

2. Advertising market (transformed per copy) (recall eq. (17)

$$\left(p_i^A - c_i^A\right)\frac{y_i^A}{y_i^N} = \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N} \tag{20}$$

Total markup:

$$(p_i^N - c_i^N) + (p_i^A - c_i^A)\frac{y_i^A}{y_i^N} = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N}$$

9.1.2 Markup competition-competition

We write the total markup when firms compete in both markets.

1. Readers market (recall eq. (16)

$$p_i^N - c_i^N = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A)\frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_{j\neq i}\frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} \tag{21}$$

2. Advertising market (transformed per copy) (recall eq. (15)

$$\left(p_i^A - c_i^A\right)\frac{y_i^A}{y_i^N} = \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N} \tag{22}$$

Total markup:

$$(p_i^N - c_i^N) + (p_i^A - c_i^A)\frac{y_i^A}{y_i^N} = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N}$$

Let us now compare them and see when colluding in advertising is better than competing:

$$-\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N} >$$
$$-\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N}$$

Simplifying terms and substituting for $(p_i^A - c_i^A)$ (which is a different term in each case) we obtain:

$$-\left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{1}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\frac{y_i^A}{y_i^N} >$$

$$-\frac{-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}}}{\frac{\partial y_i^N}{\partial p_i^N}}1\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N}$$

Simplifying we get the following condition which tells us when the markup under collusion is higher than the markup under competition:

$$\left|\frac{p_i^N}{y_i^A}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N}\right| < \left|\frac{\partial y_i^N}{\partial p_i^N}\frac{p_i^N}{y_i^N}\right|$$

which means that if the network effect is relatively high (the LHS is the aggregate elasticity of y_i^A with respect to p_i^N), then, given the observed quantities, joint profit maximization in advertising market gives a lower markup than competition in advertising market, because it implies lowering a lot the cover price markup.

On the other hand if readers' demand elasticity is relatively high, it means that cover price markup is relatively low, and therefore it is worthwhile sacrificing cover price markup to the advantage of advertising markup by colluding in the advertising market.

9.2 Case collusion-collusion vs collusion-competition

Let us now investigate whether the same logic works in the case where firms collude in the readers' market. We then want to compare the relative profitability of colluding in the advertising market with respect to competition.

9.2.1 Markup collusion-collusion

We write the total markup in the case where firms collude in both markets.

1. Readers market (recall eq. (18)

$$p_i^N - c_i^N = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A)\frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_{j\neq i}\frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \quad (23)$$

$$-\sum_{j\neq i}\left[\frac{(p_j^N - c_j^N)\frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}} + \frac{(p_j^A - c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_k \frac{\partial y_j^A}{\partial y_k^N}\frac{\partial y_k^N}{\partial p_i^N}\right] \quad (24)$$

2. Advertising market (transformed per copy) (recall eq. (17)

$$\left(p_i^A - c_i^A\right)\frac{y_i^A}{y_i^N} = \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N} \tag{25}$$

Total markup:

$$(p_i^N - c_i^N) + (p_i^A - c_i^A)\frac{y_i^A}{y_i^N} = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} +$$

$$-\sum_{j\neq i}\left[\frac{(p_j^N - c_j^N)\frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}} + \frac{(p_j^A - c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_k \frac{\partial y_j^A}{\partial y_k^N}\frac{\partial y_k^N}{\partial p_i^N}\right] + \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \frac{\sum_{j\neq i}(p_j^A - c_j^A)\frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N}$$

9.2.2 Markup collusion-competition

We write the total markup when firms collude in the readers' market but compete in the advertising market.

1. Readers market (recall eq. (18)

$$p_i^N - c_i^N = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A)\frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_{j\neq i}\frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} + \tag{26}$$

$$-\sum_{j\neq i}\left[\frac{(p_j^N - c_j^N)\frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}} + \frac{(p_j^A - c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_k \frac{\partial y_j^A}{\partial y_k^N}\frac{\partial y_k^N}{\partial p_i^N}\right] \tag{27}$$

2. Advertising market (transformed per copy) (recall eq. (15)

$$\left(p_i^A - c_i^A\right)\frac{y_i^A}{y_i^N} = \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N} \tag{28}$$

Total markup:

$$(p_i^N - c_i^N) + (p_i^A - c_i^A)\frac{y_i^A}{y_i^N} = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_j \frac{\partial y_i^A}{\partial y_j^N}\frac{\partial y_j^N}{\partial p_i^N} +$$

$$-\sum_{j\neq i}\left[\frac{(p_j^N - c_j^N)\frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}} + \frac{(p_j^A - c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_k \frac{\partial y_j^A}{\partial y_k^N}\frac{\partial y_k^N}{\partial p_i^N}\right] + \left(-\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}}\right)\frac{y_i^A}{y_i^N}$$

If we now compare the two total markups, we can see that the term

$$-\sum_{j\neq i}\left[\frac{(p_j^N-c_j^N)\frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}}+\frac{(p_j^A-c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}}\sum_k\frac{\partial y_j^A}{\partial y_k^N}\frac{\partial y_k^N}{\partial p_i^N}\right]$$

simplifies from both sides of the inequality, and therefore the condition for which collusion dominates competition in the advertising side is the same as in the previous case.