Noname manuscript No.
(will be inserted by the editor)

Merger Analysis in Two-Sided Markets: the Belgian Newspaper Industry

Patrick Van Cayseele · Stijn Vanormelingen

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Patrick Van Cayseele
LICOS and CES, KU Leuven, Naamsestraat 69, 3000 Leuven, Belgium
Tel. +32-16-326830
E-mail: patrick.vancayseele@kuleuven.be

Stijn Vanormelingen
KU Leuven, Campus Brussels, Warmoesberg 26, 1000 Brussels, Belgium
Tel: +32-16-376234
E-mail: stijn.vanormelingen@kuleuven.be

Abstract This paper builds a structural model for both advertising and readers' demand in the Belgian newspaper industry, taking into account cross network effects that exist between advertisers and newspaper readers We combine our parameter estimates with the publishers' first-order conditions to simulate the impact of a merger. We find a limited impact of the merger on reader and advertiser welfare. The effect on welfare is easily offset by possible efficiency gains. We compare the simulation outcome with the actual outcomes and find – in line with the predictions – no clear aggregate effect of the merger. The responses of individual newspapers, however, differ from the simulation. **JEL Codes:** L11, L82, C23

Keywords merger simulation · two-sided markets · newspapers · demand estimation

1 Introduction

Over the last decades, there has been a major consolidation wave in media industries worldwide, which has led to the emergence of large cross-media companies. This trend towards media ownership concentrations has raised concerns about potential harmful effects on the dissemination of accurate information. There are two possible detrimental effects of concentration in media markets: a reduction in opinion diversity/content quality, and an increase in market power by media companies [Chandra and Collard-Wexler, 2009]. Concerning the first effect, we refer interested readers to George [2007] and Fan [2013]. We focus on the second effect, as we evaluate the impact of a merger in the Belgian newspaper industry on prices and welfare.

Media markets are typical examples of two-sided markets due to the existence of network effects between advertisers and readers. We take into account the two-sided nature of the newspaper industry and estimate both advertisers' and readers' demands, which are interrelated. While advertising demand clearly depends on the readership of a newspaper, we take the assumption that readers are indifferent to advertising.[1] This way we focus on the one-way network effects from readers to advertisers. Subsequently, we build a structural model of oligopolistic competition between newspaper publishers to predict the merger effect on prices and welfare.

Using a panel dataset of newspaper level prices and quantities of both advertising and readers' side for the period 1994 to 2005 for the readers' side and 2001 to 2005 for the advertising side, we find that the cover price of newspapers is below marginal cost. Moreover, this is more pronounced for readers of *elite* newspapers. The merger that we evaluate has little impact on prices and welfare. The small welfare losses that arise from the merger are easily offset by possible efficiency gains.

Although merger simulations are now often applied when a competition authority has to decide whether to approve a merger, less is known about the accuracy of merger simulation predictions and more retrospective merger analysis is needed [Bjornerstedt and Verboven, 2016]. This paper performs such an ex-post evaluation and finds no impact of the merger on

[1] For the reasoning behind this assumption we refer to Section 3.

cover prices. The responses of the individual publishers to the ownership change are however not in line with the predictions. To the best of our knowledge, this paper provides the only ex-post evaluation of a merger simulation in a two-sided market.

The rest of the paper is structured as follows: A brief overview of the Belgian newspaper industry and a literature review is provided in Section 2, and Section 3 shows the empirical model for both the demand for advertising space and readers' demand for newspapers. The data used for the analysis are described in Section 4, and Section 5 presents the results of estimating the demand equations. Section 6 introduces a model for profit maximizing newspaper publishers that we use to infer the markups that were charged before and after the merger. Section 7 concludes.

2 The Belgian Newspaper Industry; and a Literature Review

2.1 The Belgian Newspaper Industry

Similar to other countries, Belgium has witnessed a major consolidation wave in the newspaper industry over the last decades. In 2004, the two largest publishers – *De Persgroep* and *VUM* – together accounted for around 60% of all newspapers sold and 50% of all newspaper revenue from advertising.[2] Table 1 shows daily newspaper titles in Belgium. Note that the newspaper companies typically distribute several newspapers. For example *De Morgen* and *Het Laatste Nieuws* were distributed by *De Persgroep* in 2004, while (*VUM*) published three newspapers: *Het Nieuwsblad*, *Het Volk*, and *De Standaard*.

Figure 1 shows the evolution of the price of one single newspaper copy for Dutch language newspapers and the consumer price index (CPI), normalized to the average price of a single copy in the beginning of the sample period. Before the mid 1990s, the cover price was fixed at the national level. Even after price liberalization, price increases occur mostly simultaneously, which is consistent with both "collusive" and competitive price setting. In general, *elite* newspapers have a higher cover price than *popular* newspapers[3] and among the elite newspapers,

[2]For the Dutch speaking part of Belgium alone, this fraction is even higher: almost 80% in both the reader and advertising markets.

[3]In *elite* newspapers the emphasis is more on international and political news while *popular* newspapers spend more attention to human interest, criminal news, and entertainment.

the business newspapers have the highest price. It is clear that before 2000, price increases in cover prices more or less match inflation (as measured by the CPI). Afterwards, nominal newspaper prices rise faster than the CPI.[4]

Figure 2 shows the evolution of total daily sales of Belgian newspapers. On average, sales have been falling since 1994, and this trend is especially pronounced for French language newspapers. Dutch language newspapers were able to keep their readership fairly stable in the 1990s, but witnessed a slight drop afterwards, with some exceptions.

We show a comparison between advertising and newspaper sales revenues in Figure 3. It can be seen that over the sample period, nominal revenue from advertisements increased substantially[5] while nominal sales revenue[6] remained fairly constant. As a result advertising revenue was higher than sales revenue at the end of the sample period. One needs to be careful in interpreting advertising revenues: These are computed using list prices and do not take into account possible rebates. Consequently, they are likely to be an overestimate of advertising revenue. According to De Bens and Raeymaeckers [2007], discounts are on average 30-35% of the list prices and were given primarily to large companies that advertise in several newspapers simultaneously.

We observe for each advertiser the value of advertising spent in each single newspaper which allows us to get an idea of the degree of multihoming as defined by Rochet and Tirole [2003]. In principle, an advertiser multihomes if it uses more than one newspaper to communicate to readers. Due to data limitations we assume that an advertiser multihomes when it buys in one month publicity space in more than one newspaper. This is equivalent with assuming that a firm launches at most one advertising campaign per month.

Table 2 shows the amount of multihoming, according to this definition. On average, around 53.5% of the advertising firms singlehome: buy advertising space in only one newspaper in a given month, which means that almost half of the advertisers multihome. Consequently, a substantial part of advertisements in a particular newspaper also appears in other newspapers.

[4]Cover prices of French language newspapers follow a similar pattern.

[5]One should be careful in interpreting the increase in advertising revenue from 2001 to 2002. Because in 2001 a new system to measure advertising revenue was introduced, it is likely that this revenue was under-reported in that year.

[6]Revenue from subscriptions and daily distribution through newspaper shops.

For example for *Het Volk* less than 1% of its advertisements are unique ads.[7] In contrast, more than 40% of ads in the business newspaper *De Tijd*, are unique. In general, *elite* newspapers and especially financial newspapers attract more unique advertisements than do their *popular* counterparts.

2.2 Literature Overview

There is a widely developed literature on predicting the impact of mergers on prices and welfare in traditional industries. Among others, Nevo [2000] estimates a structural model of demand and conduct to simulate merger effects in the U.S. ready-to-eat cereal industry. Pinkse and Slade [2004] study mergers in the UK brewing sector. For more on the use of econometric methods to evaluate the impact of mergers on welfare and prices, see Ivaldi and Verboven [2005] and Budzinski and Ruhmer [2010]. A recent literature evaluates the predictions of merger simulation exercises using post-merger data, see for example Bjornerstedt and Verboven [2016].

Evans and Noel [2008] show how standard merger analysis can be erroneous when applied to two-sided markets. A growing body of literature investigates the impact of ownership concentration in two-sided markets. For example, Jeziorski [2014a,b] investigate the impact of mergers in the US radio industry.

Merger studies specific to the newspaper industry include Chandra and Collard-Wexler [2009] who look at the effects on both advertising and cover prices of the merger wave in the Canadian newspaper industry in the mid 1990s. They find that the increase in concentration had no observable effects on advertising and cover prices. Closer to our work, Fan [2013] simulates the impact of a merger in US local newspaper markets on both characteristics and prices, and Filistrucchi et al. [2012] perform a merger simulation in the Dutch newspaper industry. We contribute to this literature by executing a merger simulation for the Belgian newspaper industry and provide an ex-post evaluation of this simulation.

An increasingly popular tool to conduct a merger review, is the upward pricing pressure (UPP) measure, that was introduced by Farrell and Shapiro [2010]. They show that the incen-

[7] Note that in fact we do not observe advertisements but advertising spending per newspaper/advertiser combination. To be correct, the statement should be: "less than 1% of the advertisers that bought advertising space in *Het Volk* in a given month, did not advertise in another newspaper in the same month".

tive of merging firms to unilaterally increase prices of their products, depends on the competitive closeness of the products – measured by the diversion ratio – and the profit margins of the products. This upward pressure on the price can be overturned by efficiency gains passed on to consumers. Farrell and Shapiro [2010] suggest to have an in-depth investigation of mergers that have a positive UPP value with, for example, 10% efficiency gains. Affeldt et al. [2013] extend this basic formula to a two-sided setting and show that the UPP now also depends on the diversion ratios across market sides. The advantage of the UPP is its theoretical and empirical simplicity. The methodology, however, does not predict post-merger prices, only the sign of the price changes [Farrell and Shapiro, 2010].[8] Making a thorough comparison between the UPP and a full-blown merger simulation would be an interesting exercise, but lies outside the scope of this paper. See Miller et al. [2017] for such an application in a one-sided market.

3 Empirical Model

This section presents an econometric model that takes into account both sides of the market and the interaction between them. A newspaper publisher gains revenue from both readers and advertisers. In its pricing strategy, the publisher takes into account the fact that advertisers value the readership of the newspaper. First we model advertising demand; next we present newspaper demand.

3.1 Advertising Demand

Recent economic literature about product differentiation often applies discrete choice models. However, given the numbers on multihoming shown in the previous section, a discrete choice model for advertising demand would not be appropriate. Therefore we rely on a representative advertiser model, which is similar to Rysman [2004].[9] Intuitively, a firm derives a certain value of placing an advertisement in a newspaper. This value depends on how much its profits will increase in response to the advertising campaign in the newspaper.

[8] The methodology, for example, does not take into account price changes of other firms, nor does it incorporate how the cost pass-through depends on the demand system.

[9] Rysman [2004] applies this model to describe advertising demand in the Yellow Pages industry.

Consequently, it is likely to be a function of the number of newspaper readers, the characteristics thereof, and the probability that the consumer reads and remembers the advertisement. When there is no overlap in the readership of newspapers,[10] there should be no tradeoff in the decision to buy advertising space in different newspapers. As a result, the demand for advertising in one newspaper is independent from ad prices and characteristics of other newspapers and the firm chooses separately the advertising amount in each individual newspaper, based on a comparison of the costs of the advertising space and the expected revenue from advertising in each individual newspaper.[11]

Armstrong [2006] defines markets where one side singlehomes (readers) and the other side multihomes (advertisers) as competitive bottlenecks. He also derives that the decision of agents from the multihoming side to join one platform does not depend on whether the agent chooses to join a rival platform. Moreover, he shows that there are too few ads in equilibrium from a social point of view because newspaper publishers act as monopolists on the advertising side (since advertisers have no good newspaper alternative for reaching the [singlehoming] readers of each newspaper).

Formalizing the above discussion, we assume that there are N advertisers and the representative advertiser chooses a_j: the amount of advertising[12] in newspaper j, $j = 1 \dots J$ on a particular day. Furthermore, advertisers act as price-takers. Profit to the advertiser from advertising Π is a function of the amount of advertising, the profit per informed consumer, and the number of newspaper readers:[13]

$$\Pi = f(a_1, R_1, p_{A1}, \widetilde{\pi}_1, ..., a_J, R_J, p_{AJ}, \widetilde{\pi}_J)$$

with R_j the number of readers, p_{Aj} the advertising price, and $\widetilde{\pi}_j$ the profit per consumer who reads and remembers the advertisement.

[10] This is equivalent to the assumption that a consumer reads only one newspaper a day. We keep this assumption in our model of readers' demand.

[11] If there are marketing budget constraints for advertisers, the marketing department will allocate its budget over the newspapers in order to retrieve a maximum return on its investments. Consequently, advertisers will trade off different newspapers. However, this would also mean a departure from the assumption of profit-maximizing advertisers.

[12] Throughout the paper, the quantity of advertising is expressed as the number of black and white pages.

[13] Time subscripts are omitted for simplicity.

Under the assumptions that readers singlehome and that there are constant profits for each reader who notices the advertisement, the profit function of the advertiser is separable in a_j. Then there is no reason why the choice to advertise in one newspaper should be influenced by the choice to advertise in another newspaper From the demand side, if consumers singlehome, they can be reached only by advertising in the specific newspaper they read. As a result, the advertiser's decision about the amount of advertising in newspaper j is affected only by the number of readers, their characteristics, and the price of an ad in that particular newspaper.

The assumption of constant profits per consumer says that serving many consumers because of an advertisement in newspaper j does not affect the benefit of serving extra consumers through an advertisement in newspaper k [Rysman, 2004]. The profit function of an advertiser can therefore be written as:

$$\Pi = (\widetilde{\pi}_1 G(a_1, R_1) - p_{A1} a_1^{\alpha_2}) + ... + (\widetilde{\pi}_J G(a_J, R_J) - p_{AJ} a_J^{\alpha_2})$$

where $G(a_j, R_j)$ measures the number of readers that notice and remember the advertisement, which is a function of advertising quantity purchased by the advertiser and the readership of newspaper j. We assume that $G(.,.)$ takes the Cobb-Douglas functional form:[14] $G(a_j, R_j) = \left(a_j\right)^{\alpha_1} R_j^{\beta}$. We expect α_1 to lie between 0 and 1, so there are decreasing returns to larger advertisements.[15]

A parameter $\alpha_2 > 0$ captures the shape of the price schedule for ads of different sizes: This reflects size discounting if α_2 is smaller than 1, or a price premium for larger advertisements if α_2 is larger than 1. When the advertising price increases linearly in size, α_2 is equal to 1 [Busse and Rysman, 2005]. β is expected to be positive, capturing potential network effects.

[14] We assume $G(.)$ is the same for *elite* and *popular* newspapers. The difference between the two types of newspapers lies in the profit per reader of the newspaper: $\widetilde{\pi}_j$

[15] We make the assumption that an advertiser has an ad on only one page of the newspaper. If advertisers buy advertising space on multiple pages, the returns to scale have to be interpreted as referring to the total ad quantity that is bought in the newspaper.

The advertiser chooses a_j to maximize profits from advertising in newspaper j:

$$\max_{a_j} \quad \widetilde{\pi}_j R_j^{\beta} a_j^{\alpha_1} - p_{Aj} a_j^{\alpha_2}$$
$$\Longrightarrow a_j = \left(\frac{\alpha_2 p_{Aj}}{\alpha_1 \widetilde{\pi}_j R_j^{\beta}} \right)^{\frac{1}{\alpha_1 - \alpha_2}}$$

Hence the total amount of advertising demand for newspaper j is given by $q_{Aj} = N a_j$ with N the number of advertisers:[16]

$$q_{Aj} = \left(\frac{\alpha_2 p_{Aj}}{\alpha_1 \pi_j R_j^{\beta}} \right)^{\frac{1}{\alpha_1 - \alpha_2}}$$

where $\pi_j = \widetilde{\pi}_j N^{(\alpha_2 - \alpha_1)}$. Assume that $\ln(\pi_j)$ can be written as a linear function of some observable characteristics $x_{1j}, \ldots, x_{Kj}$ of the readership of newspaper j and an unobservable term η_j. Consequently, the above can be written as:

$$\ln(q_{Aj}) = \frac{1}{\alpha_1 - \alpha_2} \ln(p_{Aj}) + \frac{\beta}{\alpha_2 - \alpha_1} \ln(R_j) + X_j \gamma + \eta_j \tag{1}$$

Equation 1 allows the estimation of demand parameters using data on advertising prices and quantities at the newspaper level.[17] The advertising demand equation includes both the advertising price and the number of readers instead of a price per reader. This is similar to Argentesi and Filistrucchi [2007] and Fan [2013] and is also consistent with the way advertising prices are listed. Armstrong [2006] shows that in the specific case of newspaper markets where readers do not care about advertising, it does not matter for the equilibrium outcome whether advertising prices are set on a per-reader basis or as a lump-sum.

Since it is likely that when advertising demand is high for unobservable reasons (for example an unobserved shift in reader characteristics) the newspaper will set a higher advertising price, advertising price is likely to be correlated with η_j. Consequently we need proper instruments

[16] The model is set up such that irrespective of the value for p_{Aj}, the optimal amount of advertising chosen by the representative advertiser is always larger than zero if π_j and R_j are strictly positive. Consequently, the advertisers will always advertise in all newspapers. A solution would be to constrain the minimal amount of advertising to be (for example) $\frac{1}{16}$ of a page.

[17] The assumptions on the functional form of advertiser profits result in a constant elasticity demand function. This functional form puts certain restrictions on price changes in response to changes in demand/costs as well as to the division of consumer versus producer surplus. As a robustness check, we perform the demand estimation and merger simulation as well using a linear function for advertising demand and the results remained qualitatively the same.

to get consistent estimates for the price coefficient. The identification of the parameters is further addressed in Section 5.1.

3.2 Readers' demand

We use a nested logit to model consumer utility. The indirect utility that consumer i derives from newspaper j depends on both product and consumer characteristics. As such, utility can be written as:[18]

$$u_{ij} = \delta_j + \nu_{ij} \tag{2}$$

where δ_j represents the mean utility of consuming newspaper j – which is common to all consumers – and ν_{ij} is the deviation from this mean and is specific to each individual consumer. A consumer chooses the newspaper that gives her the highest utility and buys one unit of it. Mean utility can be expressed as a function of the newspaper's observable characteristics X_{Nj}, its cover price p_{Nj}, and a taste parameter ξ_j, which is unobservable:

$$\delta_j = X_{Nj}\beta + \alpha p_{Nj} + \xi_j \tag{3}$$

Whether readers value advertisements positively or negatively is not clear-cut. On the one hand, it could be that more advertisements lead to a higher value of the newspaper to consumers. This is true if newspaper readers also want to be informed about promotions and special offers by firms. Kaiser and Wright [2006] find that for the German magazine industry, readers' willingness to pay for an increase in advertisements is positive and not significantly different from their willingness to pay for extra content.

On the other hand, it could also be the case that consumers view advertising as a nuisance and value the amount of advertising negatively. An obvious example is the television industry, for which Wilbur [2008] finds consumers to be strongly advertising averse. We included in several specifications the number of advertisements as newspaper characteristic. However, the coefficient always indicated that newspaper demand is independent of advertisements. The fact that we find advertising to have no impact on readers' demand for newspapers is not

[18] Again, time subscripts are omitted.

surprising and is in line with Argentesi and Filistrucchi [2007] and Fan [2013], among others. This can be explained by television ads unavoidably taking up time, while newspaper ads can be skipped over easily. The impact is also different from the magazine market, as the advertising in magazines [as in Kaiser and Wright, 2006] are special topic magazines, and contain specific ads that match this topic.[19] Given our results, we assume for the rest of the analysis that consumers do not value advertisements: neither positively nor negatively.

The nested logit model allows consumer utility to be correlated across the products that belong to the same group. In response to (for example) a price increase of newspaper j, a consumer is more likely to substitute away to newspapers in the same group than to products outside the group. On the assumption that the newspapers can be divided into G groups, the consumer-specific deviation from the mean utility ν_{ij} can be written as follows:

$$\nu_{ij} = \varepsilon_{ig} + (1 - \sigma_g)\varepsilon_{ij}$$

where ε_{ig} captures consumer i's preference for group g. and ε_{ij} and ε_{ig} have the standard nested logit distribution [Verboven, 1996].

The σ_g parameter must satisfy the following condition to be consistent with random utility maximization: $0 \leq \sigma_g \leq 1$. The higher is σ_g, the more consumer preferences are correlated across newspapers that belong to the same group. When σ_g equals zero for all groups g, the model collapses to the simple logit model. In our application, we divide newspapers into two groups, *elite* and *popular* newspapers. This is a division that is usually made in the Belgian newspaper industry: in *elite* newspapers, the focus is more on international and political news, while *popular* newspapers spend more attention to human interest, criminal news, and entertainment. *Elite* newspapers are typically sold at a higher price.

In contrast to most other papers that apply the nested logit model, we allow σ_g to differ across groups and as such consumer heterogeneity can be larger for newspapers of one group

[19] Note that the amount of advertising in each newspaper remains limited. It could very well be that for large numbers of ad pages, advertising becomes a nuisance – for example in free newspapers – but for the observed range of advertising quantities we believe that ad intensity does not play a role in consumer choice. For example Sokullu [2015] finds nonlinearities in advertising aversion for the German magazine market

compared to the other groups, see Brenkers and Verboven [2006].[20] Under the nested logit model assumptions, individual choice probabilities equal the newspaper market shares, and the demand parameters can be estimated from a linear regression of log market shares on newspaper characteristics and log group market shares (Berry 1994, Verboven 1996):

$$\ln s_j - \ln s_0 = X_{Nj}\beta + \alpha p_{Nj} + \sigma_g \ln s_{j|g} + \xi_j \tag{4}$$

where s_j is the market share of newspaper j; s_0 represents the market share of the outside good; and $s_{j|g}$ is market share of newspaper j in group g. Equation (4) shows how the logarithm of the market share of newspaper j can be written as a linear function of mean utlility of the newspaper and the logarithm of its group market share, which allows us to estimate β, α, and σ_g using linear estimation techniques. Note that $s_{j|g}$ is endogeneous by definition and needs to be instrumented. Moreover, the cover price is also likely to be endogenous and correlated with the newspaper-specific unobservable ξ_j. These identification issues will be addressed in Section 5.2

4 Data Description

On the readers' side we combine monthly circulation data for each newspaper with yearly survey data on how these sales are spread out over the different provinces. The circulation data are obtained from the association of Belgian Newspaper Publishers ($BVDU$). The surveys are conducted by *CIM*: an agency that is responsible for gathering data about all media outlets in order to inform advertisers about different possibilities for their advertising campaigns, and reports the share of each province[21] in total readership for each newspaper. Together, these datasets give us a measure of total circulation for each newspaper in each province on a yearly basis for the period 1994 to 2005.[22]

[20] The nested logit model can be seen as a special case of the random coefficients model estimated by Berry et al. [1995], Nevo [2001], and Wilbur [2008], among many others.

[21] Belgium is divided into ten provinces: five Dutch speaking and five French speaking. The population in each province varies between 200,000 in the smallest province and 1,400,000 in the largest province.

[22] In October 2000, a free newspaper was launched. We do not include this newspaper in our analysis as we lack detailed distribution figures. Moreover, we do not believe that our results would be affected by the inclusion of the free newspaper. The free newspaper contains only short factual articles – which are taken literally from press agencies – and is consequently not a good substitute for the traditional newspapers

We obtained from *BVDU* as well data on cover prices. Note that cover prices are set at the national level and are identical for all provinces. Moreover, we observe the size of the newspaper. There are three different newspaper formats in our sample: (1) *Broadsheet*, (2) *Belgian* and (3) *Tabloid*.[23] A number of newspapers shifted to a smaller newspaper size over the sample period.

On the advertising side, we obtain a measure for average advertising quantity in each newspaper on a monthly basis. We observe advertising revenue for the period January 2001 to June 2005 and obtained advertising prices for the same period.[24] Unfortunately, we observe only list prices, while rebates are likely to be granted for larger advertisers or for example during the summer period. However, as long as these do not differ too much across newspapers, this is not a serious problem for our empirical analysis as we pick up variations over time or periods with various time dummy variables. We also include a regression where we control for newspaper fixed effects, which pick up differences in rebates across newspapers.[25]

By combining the list prices, monthly advertising revenue, and the number of appearances in a given month, we obtain a measure for advertising quantity in each daily newspaper appearance, expressed in full-page black-and-white advertisement equivalents. Given that the advertising revenue was constructed using list prices, our measure for advertising quantity is not expected to be downward biased due to rebates. For each newspaper we also observe some characteristics of the readership, from the aforementioned CIM survey, such as: the socio-economic group to which the reader belongs; the fraction of readers who have children; the fraction of male readers, the fraction of readers who are responsible for the daily purchases;

from the perspective of the reader. This is confirmed in a regression of readers' demand where we include a dummy variable that is equal to one for the period when free newspapers were available. The coefficient on the dummy variable is not significantly different from zero. For advertising demand, the introduction of the free newspaper will be picked up by the time dummy variables.

[23]Broadsheet measures 540X385 millimeters (8 columns); Belgian format is slightly smaller: 490X336 mm (7 columns); tabloid is the smallest format: 385X250 mm (5 columns).

[24]We obtained the revenue data from Aegis Media, which compute revenues from observing ads in each newspaper and multiplying these with the appropriate list prices.

[25]Note that advertising prices are not expressed per square millimetres but per fraction of a full page advertisement.

and the fraction of the readers who belong to different age categories.[26] In the estimation, both advertising and cover prices are deflated with the use of the consumer price index.

In Table 3, the mean, standard deviation, and minimum and maximum of the main variables are shown. The largest Belgian newspaper (*Het Laatste Nieuws*) sold more than 300,000 copies per day in one month. The smallest newspaper (*Grenz-Echo*) sold only around 10,000 daily copies. The nominal cover price ranged from €.62 to €1.35. Abstracting from rebates, average monthly revenue from advertisements is around 2 million euros.

Although newspaper sales for *elite* titles are lower than for *popular* titles, advertising revenue is approximately the same for both types of newspapers. The former charge higher advertising prices per reader than the latter, and advertising quantity is comparable between *popular* and *elite* newspapers. As a result, the advertising revenue per copy sold is much higher for *elite* newspapers than for *popular* newspapers, which can be explained by differences in reader characteristics. Despite their higher cover prices, *elite* newspapers gain a higher share of their total revenue from advertising – 60% compared to 48% – for *popular* newspapers. [27]

All newspapers under consideration are national newspapers and are sold in each province that belong to their language group. So, Dutch newspapers are sold in all Dutch-speaking provinces. However, there exists considerable variation in sales across different provinces.

5 Results

5.1 Advertising Demand

We estimate the following equation to obtain estimates for the advertising demand parameters:

$$\ln(q_{Ajt}) = \hat{\alpha}\ln(p_{Ajt}) + \hat{\beta}\ln(R_{jt}) + X_j\gamma + \eta_t + \Delta\eta_{jt} \tag{5}$$

where q_{Ajt} is the average number of one page black-and-white advertisement equivalents that have been placed on a given day in newspaper j in month t; R_{jt} is the average number of daily

[26] In principle, we can obtain a time-varying measure for these characteristics; but given the relatively short time period for the advertising data, these characteristics do not vary much, and year-to-year variation is most likely to be due to sampling variation. Therefore we opt to use time-invariant reader characteristics that are taken from the 2003 survey.

[27] This figure probably overestimates the real share of advertising revenue in total revenue, since rebates for advertisers are not taken into account.

sales[28] in month t; p_{Ajt} is the deflated price of a one page black-and-white advertisement in month t; and X_j is a vector of readership characteristics. The own price elasticity of demand is $\hat{\alpha} = \frac{1}{\alpha_1 - \alpha_2}$ and is expected to be negative ($\alpha_2 > \alpha_1$) and $\hat{\beta} = \frac{\beta}{\alpha_2 - \alpha_1}$ captures the network effect.

Identification

The advertising price is likely to be endogenous, since an increase in advertising demand for unobservable reasons is expected to have an impact on the advertising price too. As an instrument we use the size of the newspaper, which is as we argue below correlated with the advertising price but does not influence advertising demand directly. At the beginning of our sample period, most newspapers were published in *Broadsheet* format. Some of them switched to *Belgian* format; others switched to *Tabloid* format.

Changes to narrower newspaper formats are decided at least one year in advance since they require large investments in printing facilities. Furthermore, format changes can be seen as cost shifters for ad placements: First, pages are smaller, and thus printing costs per advertising page are lower; and second, format changes typically coincide with investments in newer and more efficient printing rolls. More compact formats are assumed to have no other impact on advertising quantity than through advertising prices; format is thus a valid instrument for advertising prices.

This assumption would be violated if advertisers care about the absolute size of an advertisement expressed in mm^2s. However, *Gazet van Antwerpen* was published simultaneously in *Broadsheet* and *Tabloid* format in the period before the definite switch to tabloid. This allowed the measurement of the influence of different formats on the impact of an advertisement on consumers. The results were that not the absolute size, but rather the relative size to total newspaper size mattered for consumer responsiveness; see MediaMarketing [2004]. Consequently, we do not expect the newspaper format to have a direct impact on advertising quantity, since consumer awareness is independent of the absolute ad size given the relative size of the advertisement. This is confirmed in a simple OLS regression of Equation 5 where newspaper

[28] So, also the number of copies that are distributed for free are included.

size is also included.[29] The coefficients on newspaper formats were not significant at the 10% level.

The drawback of using the format as an instrument, is that the variable is not continuous. Therefore, we follow Argentesi and Filistrucchi [2007] and also use the number of free newspaper copies as an instrument. This can be seen as a cost of attracting advertising and therefore correlated with the advertising price.

One could also be concerned about the endogeneity of the number of newspaper readers. Following a positive shock on advertising demand, an extra consumer generates more profits from advertisements for the publisher. As a result, it will be optimal for the publisher to attract more newspaper readers, and a positive bias on the coefficient for the number of readers is expected. Therefore, we treat the number of readers as endogenous and add the simple average of cover prices of other newspapers in the same group as instruments as well as the instruments for the cover price that are used for the readers' demand equation. These instruments are expected to be related to the number of copies sold but not related to unobserved newspaper specific demand shocks as we assume that advertising demand in one newspaper is independent of advertising demand in other newspapers.[30]

Estimation Results

We use GMM to estimate advertising demand in equation 5, applying four different specifications. The first (GMM1) uses an *elite* dummy variable and a Dutch language dummy variable to capture the main reader characteristics.[31] For reasons of comparison we also included results of estimation of this equation by ordinary least squares (Column 1). The third column repeats this specification, but includes now as well the number of free copies as an instrument. The fourth column (GMM2) reports results including data from the CIM survey about Belgian

[29] However, note that this is not a formal test since we cannot control in this regression for the endogeneity of advertising price due to a lack of exogeneous instruments.

[30] Given the evolution of cover prices in Figure 1, one could as well argue that the own cover price is exogenous to newspaper-specific advertising demand shocks. Using the own cover price as instrument instead of cover prices of other newspapers renders similar results.

[31] In all our regressions, we pool the Dutch-language and French-language newspapers. In unreported results, we have tested for the equality of the coefficients for Dutch language versus French language newspapers and failed to reject the hypothesis of equality of coefficients. The same is true for readers' demand.

newspaper readers.[32] The last specification is a GMM estimation with newspaper fixed effects (GMM FE).

Standard errors are robust against heteroskedasticity and clustered at the newspaper level, which allows errors to be correlated over time for the same newspaper but not across newspapers. We insert dummy variables for each year/month combination in each specification.[33]

The Shea partial R^2 statistics are satisfactory, around 0.6-0.7 (reported in Table 4) in all specifications, which shows that large part of the variation in the endogenous variable(s) can be explained by the excluded exogenous variable(s).[34] This is true for both the readership and advertising price. It is also reflected in the F-statistic of joint significance of the excluded instruments, which is higher than 10 in all specifications.[35]

Table 4 shows the results. On the assumption that the advertising price and the number of readers are exogenous, the results from an ordinary least squares regression of Equation 5 are reported in column (1). The coefficient on advertising price is negative, highly significant, and equal to -1.28 despite an expected upward endogeneity bias. Column (2) (GMM1) corrects for the possible endogeneity of advertising price and number of readers. The coefficient on advertising price moves in the right direction: It increases in absolute value, while the coefficient on the number of readers goes up by a small amount. The number of readers has a significantly positive impact on the advertising quantity, which points to a strong network effect. The more readers that a newspaper has, the higher is the demand for advertising space that it faces.

Results from column (2) point to a price elasticity of demand of about -1.60. The network elasticity is estimated to be 1.36. From equations 1 and 5, $\beta = \hat{\beta}/-\hat{\alpha} = 1.36/1.60 = 0.85$, which implies that there are slightly decreasing returns to extra readers in the $G(.)$ function

[32] We do not have information about reader characteristics of *Grenz-Echo*, so the newspaper is dropped from the sample in this specification.

[33] The dummy variables are not reported but are jointly significant at the 1% level. They pick up seasonal and year effects as well as seasonal effects that are specific to one year – such as for example major sports events. The aforementioned problem of misreporting in 2001, is picked up by the dummy variables (as long as there is no systematic difference in reporting across newspapers). To check whether the misreporting is driving our results, we executed the regression excluding the year 2001 and results remained the same.

[34] This is a partial R^2 measure that takes into account the intercorrelations among instruments; see Shea [1997]. When there is only one endogeneous regressor, the measure is equal to "normal" partial R^2 statistics.

[35] As a rule of thumb, Staiger and Stock [1997] suggest that we do not have to worry about weak instruments if the $F-$statistic is above 10 in the case of a single endogenous regressor.

that measures the number of readers that notice and remember the ad. Note that in other specifications, β is also always close to one.

When we add the continuous instrument – the number of free copies – in column (3), the coefficient estimates are hardly affected , although the variable is highly significant in the first-stage regression of the price on exogenous variables. Advertising demand is higher for *elite* newspapers and somewhat lower for Dutch-language newspapers. In column (4), reader characteristics[36] are included in the regression. It can be seen that readers from the highest socio-economic group, households with children, and the elderly are valuable to advertisers. In the final column, we include newspaper fixed effects, which pick up all of the characteristics of the newspaper that are constant over time. Results are more-or-less similar, although the demand elasticity is estimated to be somewhat smaller.

5.2 Readers' demand

We use Equation 4 to retrieve information about readers' demand parameters. As described in Section 4, we complemented data about total newspaper sales with CIM surveys to obtain an estimate of newspaper sales per province. Unfortunately, data from the CIM surveys are available only on a yearly basis, while sales data are on a monthly base.[37] Consequently we use the yearly data for the estimations, and the unit of observation is at the newspaper-province-year level.

The groups in the nested logit model are defined as *elite* newspapers versus *popular* newspapers. The total number of potential readers is taken to be the population that is older than 15 years in each province.[38] Consequently the outside good is given by the population above 15 years who do not buy a newspaper. The implicit assumption is that each person older than 15 years old has a demand for news.

[36]These characteristics are time-invariant and are taken from the 2003 survey. We do not expect these characteristics to vary substantially over the sample period.

[37]The German language newspaper *Grenz-Echo* is excluded from the analysis since the CIM surveys do not report information on it. Moreover, this newspaper is only available in one province and is not expected to be a substitute for French-language newspapers.

[38]This choice will not influence our parameter estimates, since we include province dummy variables in the equation. However, it can have an impact on the computed price elasticities since these depend on the market share of each newspaper.

As newspaper characteristics we include the newspaper size and the "origin" of the newspaper. This is a dummy variable that is equal to one when the newspaper is originally from that particular province. French language newspapers are typically not bought by Dutch speaking inhabitants so we exclude those newspapers from the choice set in the Dutch-speaking (Flemish) provinces. The converse applies to French-language provinces. The exception is the Brussels region, which is bilingual. We lack detailed data on the Dutch- and French-speaking inhabitants of this region, and hence we cannot define the outside good. Consequently, we opt to leave Brussels out of our analysis.

The equation to be estimated is the following:

$$\begin{aligned} \ln s_{jlt} - \ln s_{0lt} = \alpha p_{Njt} + \sigma_g \ln s_{jlt|g} + \beta_1 \text{size}_{jt} + \beta_2 \text{origin}_{jl} \\ + \gamma_1 \text{trend}_t + \gamma_2 \text{trend}_t * \text{dutch}_j + \gamma_3 \text{dutch}_j + \xi_{jlt} \end{aligned} \tag{6}$$

where subscripts j and t represent newspaper and year, respectively, and subscript l indicates the province. We capture part of the unobserved characteristics ξ_{jlt} through dummy variables. More precisely: We can write $\xi_{jlt} = \xi_j + \xi_l + \Delta\xi_{jlt}$ where we can pick up ξ_j, and ξ_l through newspaper and province dummy variables, respectively. The remaining error terms are province/time specific deviations from the average mean utility level for each newspaper.

Identification

Cover prices are likely to be endogenous, since they are a function of the unobserved taste parameter.[39] We control for a large part of the unobserved taste parameter by including newspaper and province dummy variables; however it is still possible that prices react to newspaper/year specific changes in this parameter.[40]. If this is the case, we need to find instrumental variables to obtain a consistent estimate for the price sensitivity of consumers: α.

It is now common in the literature to use as instruments functions of rivals' observed product characteristics (cf. Berry et al. 1995). Unfortunately, we lack time varying data on

[39] As Nevo [2001] notes, prices are a function of marginal costs and a markup term and the markup term depends on the unobserved taste parameter.

[40] Recall that prices are set at the national level, so a single newspaper has the same cover price in each province.

newspaper characteristics except for the price and size of the newspaper. Therefore we opt to use the prices of newspapers in other geographic regions as instruments. (Nevo 2001 and Hausman et al. 1994)

The underlying assumption is that demand shocks are not correlated across regions while cost shocks are. To be precise, we use as instruments: (1) the simple average price of newspapers that belong to the same group (*elite* versus *popular*) in the other language region; and (2) the simple average price of all newspapers in the other language region.[41] Consequently, we use only group/time-specific instruments instead of newspaper/time-specific instruments. Given that the prices of newspapers within the same group tend to move together, as was shown in Figure 1, this seems to be an appropriate strategy. Moreover, these instruments are more likely to satisfy the requirement that they are not correlated with unobserved demand shocks.

There could still be concerns that demand shocks are correlated across regions, as an important part of these shocks are pieces of news. News events are often correlated across the language regions: for example, Belgian elections, September 11, etc. However, Figure 1 shows that cover prices are sticky. If cover prices reacted to pieces of news, they should display a much higher variability.

In order to identify the price coefficient, there has to exist a common marginal cost component between newspapers in different language regions. It is plausible that newspapers in the same group but different language have similar cost structures, while input prices are not expected to differ across regions.[42]

As noted before, $\ln s_{j|g}$ is endogenous by definition. As an instrument we use a dummy variable that indicates whether there is a rival newspaper present that was originally established in that province and that has a strong regional focus.[43] Moreover we include the size of other newspapers as an instrument, since this is the only time-varying characteristic of newspapers

[41] Note that these instruments are different from the instruments used in Hausman et al. [1994] and Nevo [2001], since those authors use the price of the same goods in other geographic areas. This is not feasible in our study because the cover price of newspapers is the same in every province.

[42] For example, the prices of inputs such as paper are not expected to differ across regions in Belgium, given the limited geographic size of the country. Moreover, wage bargaining in Belgium takes place mainly at the national level.

[43] For example, *Gazet van Antwerpen* was founded in Antwerp and large parts of its content are devoted to news from the province of Antwerp.

that we observe. We assume that the other newspaper characteristics are exogenous, which is an assumption that is often made in empirical discrete choice models of product differentiation.

Estimation Results

Table 5 shows the results of the estimation of equation 6. Column (1) displays the estimates of the logit model without controlling for the endogeneity of the cover price. This indicates a marginally significant positive coefficient for the price variable. Controlling for endogeneity of the price variable in column (2) generates better results as, the price coefficient becomes significantly negative in accordance with economic theory. Columns (3) to (5) report estimates for the nested logit model where consumer preferences are allowed to be correlated across newspapers in the same group. Column (3) shows the results for a specification without newspaper dummy variables. Columns (4) and (5) have newspaper dummy variables included. Column (4) restricts the nesting parameter to be the same for both *elite* and *popular* newspapers, while column (5) allows the parameter to differ between the two groups.[44]

From the results for the nested logit model, it is clear that there is a statistical significant correlation of preferences across newspapers of the same group. The coefficient on $\ln s_{j|g}$ – which measures the correlation of preferences across newspapers in the same group – is estimated to be 0.546 without the inclusion of newspaper dummy variables (column 4) and 0.738 with newspaper fixed effects (column 5). This indicates that consumers will switch more easily between newspapers of the same group than between newspapers of different groups. The hypothesis that $\sigma = 1$ can be rejected at standard significance levels: Newspapers within one group are not perfect substitutes. Allowing for a different nesting parameter for both groups in column (5) shows that the correlation of consumer preferences across newspapers in the same group is lower for *elite* newspapers. This indicates that consumers view *elite* newspapers as less substitutable. However, the difference between the two nesting parameters is not significant.

The coefficient on the cover price is negative and significant at the 10% level. Not surprisingly, consumers prefer newspapers that were originally founded in the same province in which

[44]Both the province and newspaper dummy variables are jointly significant in all specifications.

they reside, as is shown by the positive coefficient on the Origin variable. Finally, the size of the newspaper does not seem to matter to consumers.

The Hansen test statistics never rejects the validity of the instruments used.[45] In columns (2) to (4), both the partial R^2 and $F-$test point to relatively strong instruments that can explain considerable variation in the endogenous variables. However, there could be concerns that in column (5), the coefficient on the interaction between the group dummy variable and market share in the same group is only weakly identified. This could also explain the high standard error on the coefficient.

Price elasticities that are computed with the flexible specification of Column (5) in Table 5 are shown in Table 6.[46] The own price elasticities range from -0.96 to -2.63 and are on first impression relatively low in absolute value, since they would imply high markups. However, recall that also the advertising side needs to be taken into account in the analysis. Due to the lower nesting parameter, price elasticities are smaller for *elite* newspapers compared to *popular* newspapers, which is in line with intuition. The estimates suggest that the price elasticity of total newspaper demand is equal to -0.65. We found this elasticity by hypothetically increasing all newspaper cover prices by 10% and recomputing newspaper sales of all newspapers given this price increase. Regressing total newspaper sales on an aggregate price index of cover prices resulted in a demand elasticity of -0.54, which is close to our estimate for the demand elasticity using the nested logit model.

For the rest of the analysis we will use the parameter estimates of the flexible model.

[45] However, the Hansen statistic only makes sense when there are at least as many valid instruments as there are endogenous regressors. Given that the overidentification comes from the use of both average cover prices in the same group (*elite* or *popular*) but other region, and average cover prices of both groups in the other region, the Hansen $p-$value should be interpreted with care. It is hard to imagine a situation where average prices of other region newspapers in the same group are valid instruments and average prices over all other region newspapers are not or vice versa.

[46] Price elasticities are computed for each newspaper in each province in the year 2004. Subsequently, a weighted average of these elasticities has been taken, using as weights the population in the province, to get an estimate of the total price elasticities for each newspaper across all provinces. Those are the figures that are reported in Table 6. Consequently, the cross-price elasticities between newspaper j and the other newspapers at the national level are not the same any more for each newspaper in the same group but will be (for example) higher between newspapers that have a strong presence in the same provinces.

6 Equilibrium

In this section, we derive from the reported demand parameters the markups that are set by newspaper publishers at both the advertising and readers' sides. To this end, we build a model for profit-maximizing publishers that typically distribute multiple newspapers, and we derive their first-order conditions. These are used to compute marginal costs and markups under the assumption of constant marginal costs. In a final step we use the model to simulate the impact of an actual newspaper merger on prices and welfare.

6.1 Model

There exist K different newspaper publishers, each of whom produces a subset Ψ_k of the $j = 1 \dots J$ different newspapers. Each newspaper is sold by only one publisher, such that the subsets Ψ_k are mutually exclusive. We assume there is a constant marginal cost that is associated with the printing of a newspaper copy c_j^N and with placing an ad in newspaper j: c_j^A. Under the assumption that newspaper demand is independent of advertising quantity but advertising demand depends on the number of readers, total profits Π_k for publisher k can be written as follows:

$$\Pi_k = \sum_{j \in \Psi_k} (p_{Nj} - c_{Nj}) q_{Nj} (\mathbf{p_N}) + \sum_{j \in \Psi_k} (p_{Aj} - c_{Aj}) q_{Aj} (\mathbf{p_A}, \mathbf{q_N}) - C_k \tag{7}$$

where C_k are fixed costs of publishing n_k different newspapers for publisher k. It can be seen that the quantity of newspapers that are sold depends on the price vector $\mathbf{p_N} = (p_{N1}, \dots, p_{Nj} \dots p_{NJ})$, which includes not only the price of newspaper j, but also the prices of all other newspapers that are owned by the same or different publishers.

Advertising quantity q_{Aj} is not only a function of the price vector $\mathbf{p_A} = (p_{A1}, \dots, p_{Aj}, \dots, p_{AJ})$, but also of the number of readers of all newspapers $\mathbf{q_N} = (q_{N1}, \dots, q_{Nj}, \dots, q_{NJ})$. The assumption that advertising demand for newspaper j is independent of the prices and characteristics of other newspapers is implemented at the end of this section. First, we derive the most general expressions for profit maximizing prices. We assume that there exists a Bertrand-Nash equilibrium with positive prices. Solving the publishers' profit-maximization problem generates the

first-order conditions. There are two FOC's for each individual newspaper j that is owned by publisher k, one for the advertising side and one for the readers' side:

Advertising Price:

$$\frac{\partial \Pi_k}{\partial p_{Aj}} = q_{Aj} + \sum_{r \in \Psi_k} (p_{Ar} - c_{Ar}) \frac{\partial q_{Ar}}{\partial p_{Aj}} = 0 \tag{8}$$

Cover Price:

$$\frac{\partial \Pi_k}{\partial p_{Nj}} = q_{Nj} + \sum_{r \in \Psi_k} (p_{Nr} - c_{Nr}) \frac{\partial q_{Nr}}{\partial p_{Nj}} + \underbrace{\sum_{r \in \Psi_k} \sum_{i \in J} (p_{Ar} - c_{Ar}) \frac{\partial q_{Ar}}{\partial q_{Ni}} \frac{\partial q_{Ni}}{\partial p_{Nj}}}_{\text{Network Effects}} = 0 \tag{9}$$

The FOC for the advertising price is the standard formula for multiproduct firms in an oligopolistic setting, since readers' demand is independent of the number of advertisements. The FOC for the cover price, however, incorporates the network effect, represented by the last term in Equation 9. When the publisher increases the cover price of newspaper j, it will lose readers; as a result, advertising demand for newspaper j will be smaller. Moreover, because part of the foregone sales go to other newspapers, demand for advertising increases for those newspapers vis-à-vis newspaper j. These effects cause markups for the cover price to be smaller compared to a standard differentiated product setting. Part of this effect, however, is mitigated because there are multiproduct publishers present. When publisher k increases the cover price of newspaper j, the demand for advertising in j will be smaller, but demand for advertising in the other newspapers in ks portfolio increases, which softens the downward pressure on markups realised on the readers' side. In matrix notation, one can write the vector of markups on the advertising side as follows:

$$\mathbf{q_A} + \Lambda \odot (\mathrm{D}_{p_A} \mathbf{q_A})' (\mathbf{p_A} - \mathbf{c_A}) = \mathbf{0}$$

$$\iff (\mathbf{p_A} - \mathbf{c_A}) = - \left[\Lambda \odot (\mathrm{D}_{p_A} \mathbf{q_A})' \right]^{-1} \mathbf{q_A} \tag{10}$$

where Λ is the $J \times J$ ownership matrix of which the element at column r and row j is equal to 1 if there is a publisher who owns both newspapers j and r, and 0 otherwise. The $J \times 1$ vector of markups is given by $\mathbf{p}_A - \mathbf{c}_A$, and $\mathbf{q}_A$ is a $J \times 1$ vector of advertising quantities. The operator $\odot$ denotes the element-by-element matrix multiplicator (Hadamard product), and $D_{p_A}\mathbf{q_A}$ is the $J \times J$ Jacobian matrix of the vector function $\mathbf{q}_A(\mathbf{p}_A)$, i.e. $D_{p_A}\mathbf{q_A} \equiv \frac{\partial(q_{A1},\ldots,q_{AJ})}{\partial(p_{A1},\ldots,p_{AJ})}$.

The expression for cover markups can be written in a similar way. Let $\mathrm{D}_{\mathbf{p}_N}\mathbf{q}_N \equiv \frac{\partial(q_{N1},\ldots,q_{NJ})}{\partial(p_{N1},\ldots,p_{JN})}$ be the $J \times J$ Jacobian matrix of first derivatives of $\mathbf{q}_N(\cdot)$ with respect to $\mathbf{p}_N$ and likewise $\mathrm{D}_{\mathbf{q_N}}\mathbf{q}_A \equiv \frac{\partial(q_{A1},\ldots,q_{AJ})}{\partial(q_{N1},\ldots q_{NJ})}$. The J first-order conditions for newspaper markups are given by:

$$\mathbf{q}_N + \left(\Lambda \odot \left(\mathrm{D}_{\mathbf{p}_N}\mathbf{q}_N\right)'\right)\left(\mathbf{p}_N - \mathbf{c}_N\right) + \left(\Lambda \odot \left(\mathrm{D}_{\mathbf{q}_N}\mathbf{q}_A\mathrm{D}_{\mathbf{p}_N}\mathbf{q}_N\right)'\right)\left(\mathbf{p}_A - \mathbf{c}_A\right) = \mathbf{0}$$

$$\Longleftrightarrow \left(\mathbf{p}_N - \mathbf{c}_N\right) = - \left(\Lambda \odot \left(\mathrm{D}_{\mathbf{p}_N}\mathbf{q}_N\right)'\right)^{-1}\left(\mathbf{q}_N + \left(\Lambda \odot \left(\mathrm{D}_{\mathbf{q}_N}\mathbf{q}_A\mathrm{D}_{\mathbf{p}_N}\mathbf{q}_N\right)'\right)\left(\mathbf{p}_A - \mathbf{c}_A\right)\right) \quad (11)$$

Equations 10 and 11 show FOCs for both advertising and cover prices for each newspaper $j = 1, \ldots J$ in equilibrium. The assumption that demand for advertising in newspaper j is independent of characteristics and prices of other newspapers implies that the matrix $\mathrm{D}_{\mathbf{q}^N}\mathbf{q}^A$ has all off-diagonal elements that are equal to zero. The network effects in equation 9 are restricted to the impact of price changes on own advertising demand through the impact of its own readership.

6.2 Markups

Tables 7 and 8 show average markups on both the readers and advertising side that are computed with the use of the estimation results that were presented in the previous sections and the expression for the markups in equations 10 and 11. The figures that are presented, are computed under the assumption of multi-product profit-maximizing publishers that compete in prices.[47] The reported markups are weighted averages of all newspaper markups with sales

[47] Without taking into account the acquisition of *De Tijd* and *L'Echo*.

as weights and are computed for 2004.[48] The markups are measured in euros. Both tables report markups that are computed using readers' demand parameters from the flexible model (column 5 of Table 5). For Table 7, the advertising demand parameters are taken from the specification without newspaper fixed effects (Column 2 of Table 4), while the parameters from the specification with fixed effects (column 5 of Table 4) are used in Table 8.

All specifications show that newspaper publishers make negative profits on the readers' side, and this is true for both *elite* and *popular* newspapers. For the base model without advertising fixed effects, publishers make on average a loss of € 0.32 at each copy sold at the readers' side. Although the price elasticity of demand is lower in absolute value for *elite* newspapers, markups on the readers' side are even more negative than those of *popular* newspapers. This because a reader of an *elite* newspaper generates more advertising profits as compared to a *popular* newspaper reader.[49] The last three columns of Table 7 show the profits that are made per newspaper copy sold. It can be seen that the negative markups at the readers' side are more than compensated by revenues from the advertising side, such that the average publisher gains € 0.27 per newspaper copy sold. Total markups are higher for *elite* newspaper compared to *popular* newspapers: €0.43 versus €0.23.

Table 8 shows the same exercise, but now with advertising parameters from the specification with newspaper fixed effects. Similar results emerge, and the losses on the readers' side now are even larger. The reason is that newspapers set a higher markup on the advertising side because of a lower estimated price elasticity of advertising demand, while the network elasticity is only slightly lower. Consequently, newspaper publishers gain a higher advertising profit per reader and are willing to set a lower cover price to attract more readers.[50]

[48] Belgian newspaper publishers set a cover price that is the same in each single province. Consequently, we compute average demand elasticities, weighted by sales in each province, at the national level to infer markups. As such we retrieve an estimate for marginal costs only at the national level – not at the provincial level.

[49] Note that the absolute advertising markup is lower for *elite* newspapers. However, *elite* newspapers typically have fewer readers such that the ad markup per reader is higher.

[50] As mentioned before, the co-movement of cover prices displayed in Figure 1 could be the result of collusion among newspaper publishers. If newspaper publishers are colluding instead of competing in prices, our markup estimates are too low, and thus marginal costs estimates are too high. We computed as well markups and marginal costs under the assumption of joint profit maximization. Now, the average markup on the readers' side increases to €0.593 and €−0.056 for *popular* and *elite* newspapers, respectively. Note as well that if publishers are colluding, there will be no impact of the merger (discussed below) on prices.

The reason for readers to pay less than what they cost are twofold: Armstrong [2006] shows how the prices that are charged in two-sided markets are different from standard price setting in one-sided markets. The difference depends on two factors: First, prices to side-1 agents are lower the larger the number of side-2 agents that are attracted by one extra side-1 agent. Second, prices to side-1 agents are lower the higher are the profits that are realized per side-2 agent. In the newspaper industry, there exists a strong network effect from readers to advertisers, and profits per reader from the advertising side are relatively high because the publisher can charge monopoly prices on this side (as a consequence of the readers' singlehoming tendencies). Consequently, cover prices will be low and even below marginal costs, as was previously shown. Since readers do not care about ads, there is no network effect from advertisers to readers, and advertisers are charged the standard monopoly prices.

We can also infer estimates for the marginal costs of printing and distributing a newspaper as well as the marginal cost of including one extra advertisement. Unfortunately, we lack the detailed data about the actual cost structure of newspaper publishers that would allow comparisons with our estimates. However, we find the lowest marginal costs for newspapers whose sales are largely concentrated in one specific region,[51] which coincides with intuition since distribution costs are lowest for these newspapers.

6.3 Merger Simulation

At the end of 2004, the newspaper *De Tijd* announced that it was looking for an acquirer as the owners believed it could not survive as a small player in the oligopolistic newspaper industry. Almost all other publishers expressed their interest in *De Tijd*; but in April 2005, it was announced that *De Persgroup* – the owner of *De Morgen* and *Het Laatste Nieuws* – would take over *De Tijd*.[52] In September 2005, the merger was approved by the Belgian competition authorities.

[51] For example, *Belang van Limburg* and *Gazet van Antwerpen* have the lowest marginal costs.

[52] Note that at that point, *De Persgroep* was already distributing the French-language counterpart of *De Tijd*.

In this section we predict the impact of the merger between *Het Laatste Nieuws/De Morgen* and *De Tijd* on welfare.[53] We continue to assume that newspaper publishers set their prices non-cooperatively. As a result there exist only the unilateral effects of the merger. We redefine the ownership matrix in equation 11, and we numerically search for the new prices that satisfy the first-order conditions in equations 8 and 9. With the simulated post-merger prices at hand, we compute producer and consumer surplus and compare it with the pre-merger situation.

It is likely that there are efficiency gains that were associated with the merger. First of all, one can expect newspapers to share part of their fixed costs; but it is also possible that variable costs decreased due to more efficient distribution or printing. Therefore we assume three different scenarios: 1) no efficiency gains of the merger; 2) a 2% reduction in marginal costs on the readers' side; and 3) a 2% reduction in marginal costs on both the readers' and the advertisers' sides.

The outcome of the exercise is reported in Table 9. Even when there are no efficiency gains, the merger has only a marginal impact on total welfare as measured by the sum of producer surplus and consumer surplus. Total welfare drops by only 1.12% and 1.35% for the specifications with and without newspaper fixed effects on the advertising side, respectively. This reflects the limited change in cover prices in response to the merger between *Het Laatste Nieuws/De Morgen* and *De Tijd*.[54] For example, in the specification without newspaper fixed effects in advertising demand, average cover prices[55] rise by only 1.8% and circulation drops by only slightly more than 1% after the merger.

A first explanation for this finding are the limited cross-price elasticities between newspapers. Especially the newspapers that belong to different groups have low cross-price elasticities with each other. A second factor that causes the merger to have a small effect on prices and welfare is the presence of the advertising side. Increasing the cover price means not only lost sales on the readers side but also less profits from advertisers. The gain in readership for the

[53] We focus on the Dutch-language newspapers in Flanders since we lack precise data on the number of Dutch-speaking people in Brussels. This number is low however, so ignoring Brussels will not introduce a bias in our merger simulation.

[54] Note that the impact of the merger on the advertising side is limited to the changes in readership that shift the inverse advertising demand curve. This because newspaper publishers act as monopolists on the advertising side.

[55] These are weighted averages with circulation as weights.

non-merging newspapers due to the price increase of the merging newspapers, causes a disproportionate increase in advertising demand because the network elasticity is larger than one. As a result, there is downward pressure on their cover price, which limits their increase in the cover price.

Looking at the different components of total welfare, one can see that as expected producer surplus increases, whereas consumer surplus decreases on both sides, due to the lower circulation of newspapers.[56]

A 2% efficiency gain on the readers' side reduces the welfare loss to almost zero. The reason is that in response to the decrease in marginal costs, the cover price of *Het Laatste Nieuws*, the largest newspaper, decreases by 3%. As a result there is only a very limited drop in total Dutch language newspaper sales. When there is a 2% drop in marginal costs on both the readers and advertisers' side, there is an even larger downward pressure on the cover prices of newspapers that are involved in the merger, as the advertising side becomes more profitable for the merging parties. Now in both specifications, welfare increases. Variable profits of the publishers go up by more than 2% after the merger.

The results show that allowing the merger implies that newspaper publishers can realize higher variable profits to cover their large fixed costs. The impact on consumer welfare of the merger remains fairly limited, especially when possible efficiency gains are taken into account. Although the cover prices of the newspapers that were involved in the merger go up, there is only a limited effect of the consolidation on total newspaper circulation; hence consumer surplus on the advertising side hardly changes.

Note that our finding is consistent with Chandra and Collard-Wexler [2009] who examine the impact of concentration on advertising and cover prices in Canada. They find no evidence of higher prices in more concentrated markets. The results are also very much in line with those of Filistrucchi et al. [2012], who simulate the impact of a hypothetical merger in the Dutch newspaper industry and find very limited effects on cover prices. Fan [2013], however, finds somewhat larger effects.

[56] Again, in a previous version of the paper, we executed the merger simulation exercise for the specification with linear advertising demand. The main results were not dependent on the chosen advertising demand system.

6.4 Evaluation

In this subsection, we will check how prices actually evolved after the merger. To do this, we complement our dataset with more recent data. We focus on cover prices, as we do not expect any effects of the merger on advertising prices in the absence of efficiency gains. Figure 4 shows the evolution of the average cover prices for the different groups for the period 2003 to 2007. The first vertical line shows the date the merger was announced, while the second shows the date when the merger was finally approved by the competition authorities. At first impression, there is not much activity, except at the end of the period when the cover prices of Dutch-language newspapers appear to increase. This increase, however, is the same for *elite* as well as for *popular* newspapers, which makes it unlikely to have been caused by the merger.

To test more formally for the effects of the merger on prices, we execute the following regression, similar to Ashenfelter and Hosken [2010]:

$$\ln p_{jt} = \delta_j + \beta_1 \left(\text{PostMerger}_t \times \text{MergingNewsp.}_j\right) + \delta_t + \epsilon_{jt} \tag{12}$$

where $\ln p_{jt}$ is the natural logarithm of the cover price of newspaper j in period t. As a regressor we include the interaction between a post-merger dummy variable that is equal to 1 after the merger was approved, and a dummy variable that is equal to 1 for the newspapers that were involved in the merger. We include as well newspaper dummy variables and year-times-month dummy variables. When executing this regression on the subsample of Dutch-language newspapers, β_1 measures whether the parties involved in the merger have increased their prices by more than the outsiders.

The results of this exercise are reported in Column (1) of Table 10. We find that the price change of the merging firms is on average the same as for the non-merging Dutch-language firms. We also report a specification that includes the French-language newspapers as a benchmark for comparisons with the evolution of the Dutch-language newspapers. The results show that the prices of Dutch-language newspapers have decreased relative to French-language newspapers. However, this is unlikely to be due to the merger, as this holds for all newspapers, and there is no differential effect for Dutch *elite* newspapers relative to their

French counterparts. Figure 4 shows, however, that this effect is also due to a price increase of French newspapers, right after the announcement, which is only matched by a price increase of Dutch newspapers after some time.

The changes in cover prices of the individual newspapers, however, are not in line with the predictions. According to the simulation, the prices of the merging *elite* newspapers (*De Tijd* and *De Morgen*) should increase by more than the price of the *elite* newspaper that is outside the merger (*De Standaard*). In reality however, the actual cover prices of the *elite* newspapers continue to move together for one year after the merger. Afterwards, the actual cover prices of *De Tijd* and *De Standaard* increase, while the cover price of *De Morgen* does not change. Bjornerstedt and Verboven [2016] find in their evaluation as well that the price changes of individual firms in response to the merger conflict with the predictions of the merger simulation.

There could be various reasons for the divergence between our predicted and observed price changes. One explanation could be that the newspaper publishers are (partially) coordinating on prices, instead of behaving as multi-product Bertrand-Nash competitors. For example, Argentesi and Filistrucchi [2007] find tentative evidence of price coordination in the Italian newspaper industry. Note that the institutional setting in Belgium is the same: a long period of regulated prices, followed by price liberalization.

7 Conclusion

The newspaper industry is a notable example of a two-sided market: Advertisers' demand depends on the number of readers. This paper builds an empirical framework for both demand for publicity space in newspapers and the demand for newspapers by consumers. Moreover, the fact that advertisers multihome is incorporated in the model. Using estimated demand parameters for both advertisers' and consumers' demand, together with the supply function of a profit-maximizing newspaper publisher that takes both revenues from advertising and consumers into account, we find negative markups on the readers' side. The fact that one side (advertising) pays a high price while the other side (readers) faces prices that are lower than marginal costs is a characteristic that can be found in several other two-sided markets.

We perform a merger analysis in that we simulate the impact of the merger between *Het Laatste Nieuws/De Morgen* and *De Tijd* on prices and welfare. Because consumers singlehome, newspapers act as monopolists on the advertising side. Consequently, the impact of the merger on the advertising side is limited to the changes in readers' demand.

On the readers' side, we find only a limited effect on cover prices, hence in response to the merger, consumer surplus hardly changes. However, there arises a considerable increase in variable publisher profits, especially when possible efficiency gains are taken into account. We compare the simulation with the actual outcomes and find no evidence of changes in the cover prices in response to the merger.

Acknowledgements We thank the editor, two anonymous referees, Filip Abraham, Anneleen Forrier, Lisa George, Joep Konings, Jo Van Biesebroeck, Ambarish Chandra, Gregory Crawford, Jan De Loecker, Lapo Filistrucchi, Damiaan Persyn, Charles Romeo, Ricardo Ribeiro, John Sutton, Pasquale Schiraldi, Frank Verboven, and participants at the IIOC Conference in Savannah, EARIE Conference in Valencia, MIE Spring Camp at KU Leuven, LSE Work in Progress Seminar Series, and IESE SP-SP Luch Seminar Series for useful comments and suggestions. **Disclosure** Patrick Van Cayseele has been an expert member of the Belgian antitrust authority and was involved in consulting practice in many merger cases in the Media industry.

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8 Tables and figures

Fig. 1 Cover Price Dutch Language Newspapers

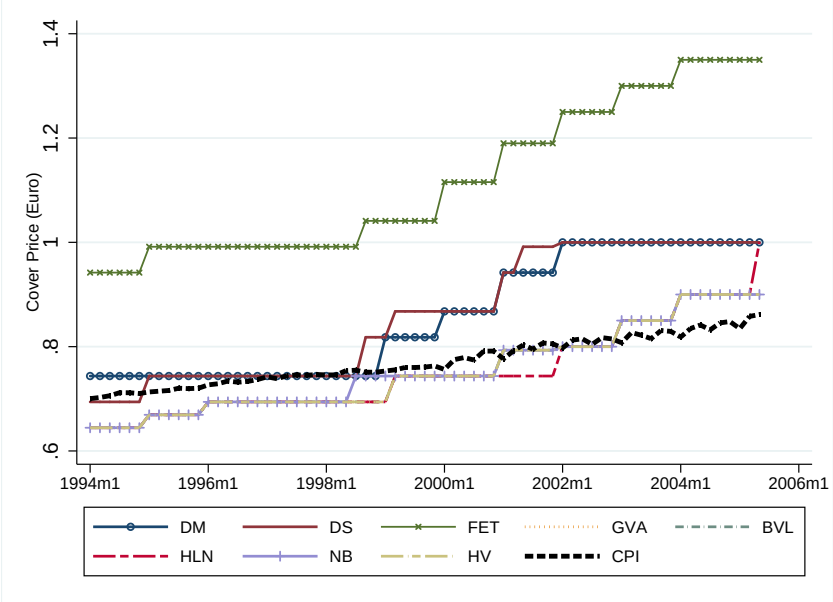

Fig. 2 Total Daily Sales Belgian Newspapers

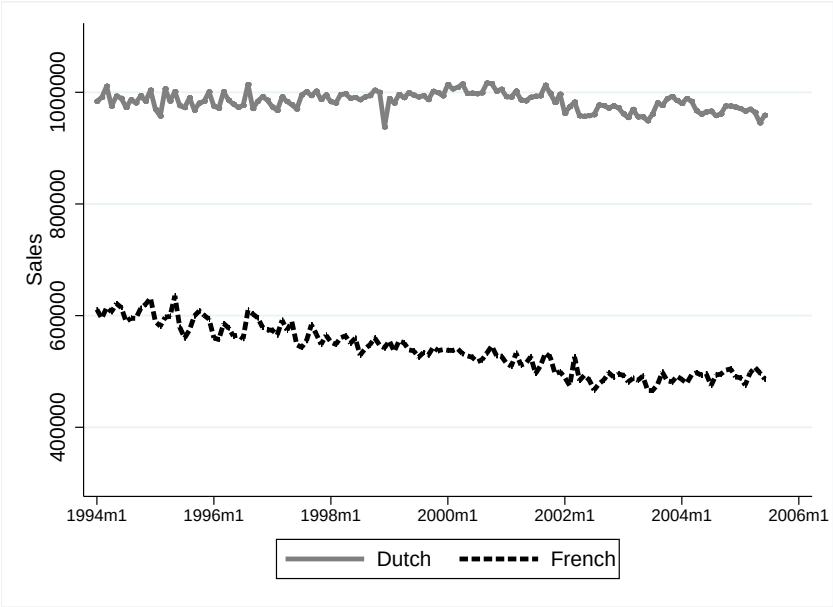

Fig. 3 Advertising and Sales Revenue for All Newspapers

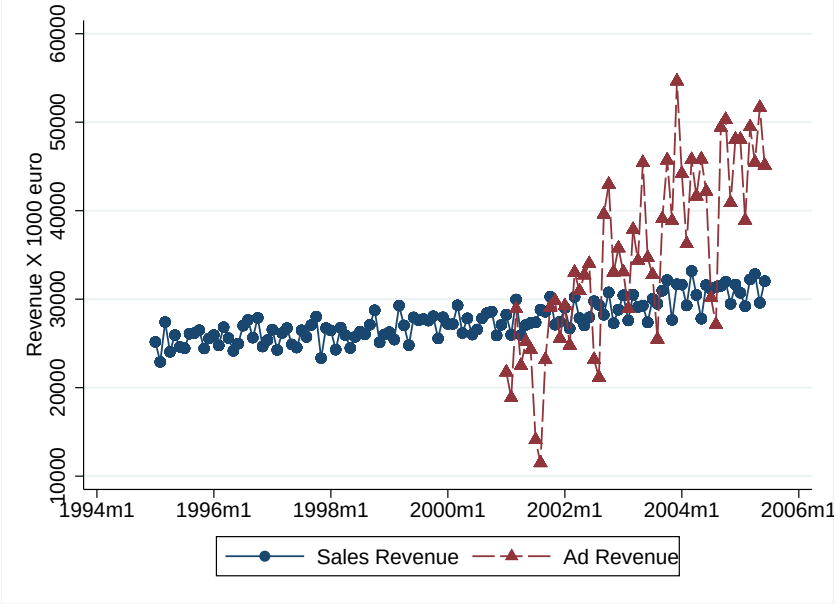

Fig. 4 Cover Price before and after Merger

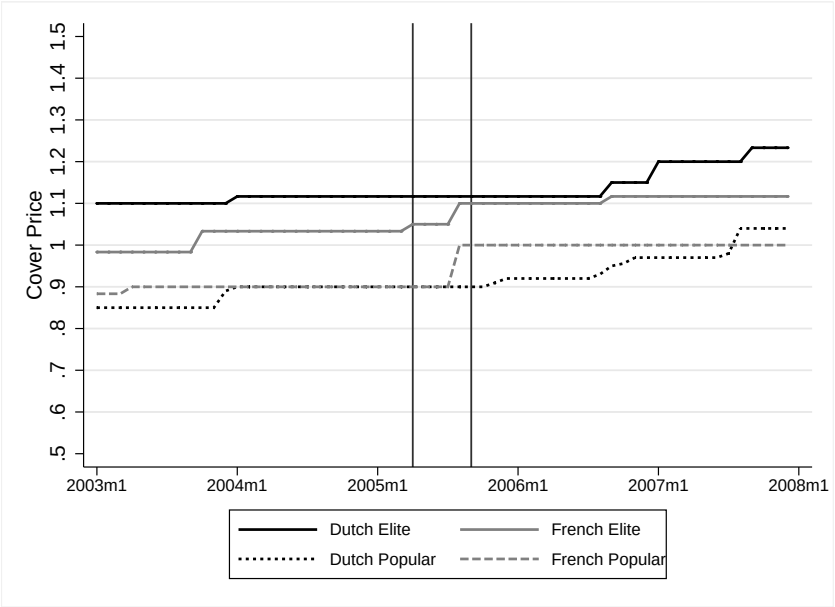

Table 1 Belgian Newspapers

	Elite	Popular	Free
Dutch	De Morgen (DM)	Het Laatste Nieuws (HLN)	Metro NL (METN)
	De Standaard (DS)	Het Nieuwsblad (NB)	
	De Tijd (FET)	Het Volk (HV)	
		Gazet van Antwerpen (GVA)	
		Belang van Limburg (BVL)	
French	Le Soir (LS)	Sud Presse (SUD)[a]	Metro FR (METF)
	La Libre Belgique (LLB)	Vers l'Avenir (VA)	
	L'Echo (LECH)	La Dernière Heure (DH)	
German		Grenz-Echo (GRE)	

Table 2 Number of Advertisements per Newspaper by Individual Advertisers

Nr. of newspapers	Frequency	Percentage
1	19662	53.5%
2	7015	19.1%
3 to 5	5781	15.7%
6 to 10	2527	6.9%
More than 10	1796	4.9%
Total	36781	100%

[a]Sud Presse was founded in 1999, following the merger between La Nouvelle Gazette and La Meuse

Table 3 Summary Statistics

	Mean	S.D.	Min.	Max.
Readers				
Copies Sold (daily)				
Elite	61953	34253	17502	177968
Popular	124868	74082	10067	303941
Total	100325	68889	10067	303941
Price per copy (€)				
Elite	.90	.18	.62	1.35
Popular	.76	.09	.62	1.00
Total	.81	.15	.62	1.35
Advertising				
Revenue (monthly X1000 €)				
Elite	2212	1402	40.6	5869
Popular	2407	1762	118	8199
Total	2329	1630	41	8199
Quantity (nr. pages per copy)				
Elite	6.95	3.73	.24	18.9
Popular	6.61	2.97	1.56	15.8
Total	6.75	3.30	.24	18.9
Price (€)				
Elite	12874	4588	6738	22000
Popular	13794	6826	2200	30000
Total	13426	6045	2200	30000
Price per 1000 Copies Sold (€)				
Elite	248	90	128	494
Popular	124	41	64	252
Total	174	89	64	494
Revenue per Copy Sold				
Elite	1.51	.58	.09	3.38
Popular	.77	.31	.123	1.69
Total	1.07	.57	.09	3.38
Share of Ad Revenue in Total Revenue				
Elite	.60	.12	.09	.82
Popular	.48	.10	.14	.71
Total	.52	.12	.09	.82

Table 4 Results: Ad Demand

	(1) OLS	(2) GMM1	(3) GMM2	(4) GMM 3	(5) GMM FE
Log Ad Price	-1.284***	-1.604***	-1.552***	-1.115***	-1.211***
	(.196)	(.208)	(.202)	(.26)	(.298)
Log Readers	1.195***	1.357***	1.373***	0.856***	1.285**
	(.147)	(.157)	(.153)	(.226)	(.621)
Dutch	-0.175*	-0.138	-0.156*		
	(.0935)	(.0892)	(.0859)		
Elite	0.794***	0.915***	0.955***		
	(.121)	(.114)	(.111)		
% Male				-4.164	
				(3.11)	
% High Soc.				2.045***	
				(.567)	
% Children				4.923***	
				(1.84)	
% Purchases Resp				0.118	
				(2.3)	
% Age 35-44				1.746	
				(5.22)	
%Age 45-55				-1.078	
				(4.36)	
% Age 55+				3.242**	
				(1.64)	
Obs.	795	795	795	689	795
Nr. Clusters	15	15	15	13	15
$p-$Hansen		.341	.214	.242	.259
Price Shea R^2		.653	.762	.631	.71
Readers Shea R^2		.744	.793	.527	.218
Price F Stat		28.5	133	59.4	15
Readers F Stat		82.9	156	24	13.4

Standard errors in parentheses

* p< 0.10, ** $p < 0.05$, *** p< 0.01

All specifications include dummy variables for every year/month combination.

Standard errors are robust against heteroskedasticity and clustered at the newspaper level.

Excluded instruments are the format, the average cover price of other newspapers in the same group, and the average cover prices of newspapers in the other language region. In columns (3) to (5) the number of free newspapers is included as well as the instruments.

Table 5 Results: Readers' Demand

	(1) Logit OLS	(2) Logit GMM	(3) Nest.Logit1	(4) Nest.Logit2	(5) Nest.Logit3
Cover Price	.572	-1.54*	-1.44***	-.824*	-.982*
	(.374)	(.799)	(.518)	(.423)	(.505)
$\ln(s_{j\|g})$			.546***	.738***	.761***
			(.152)	(.119)	(.117)
Elite$\times \ln(s_{j\|g})$					-.313
					(.481)
Origin	3.44***	3.44***	.989***	.974**	.884**
	(.571)	(.559)	(.368)	(.454)	(.449)
Size	-.0451	.0421	-.997	.0627	.159
	(.275)	(.279)	(.769)	(.155)	(.223)
Trend	-.0206**	.00604	-.000168	-.0134**	-.00868
	(.00888)	(.0136)	(.011)	(.0067)	(.01)
Dutch × Trend	.0139	.0136	.0155	.0282***	.0261***
	(.00937)	(.0101)	(.00975)	(.00481)	(.00589)
Qual			-.676***		
			(.214)		
Obs.	865	865	865	865	865
Nr. Clusters	80	80	80	80	80
p Hansen		.781	.172	.521	.454
Price Shea R^2		.176	.072	.176	.2
$\ln(s_{jg})$ Shea R^2			.0398	.14	.122
Elite $\times \ln(s_{j\|g})$ Shea R^2					.012
Price F Stat		246	23.4	246	238
$\ln(s_{j\|g})F$ Stat			9.49	8.04	6.17
Elite $\times \ln(s_{j\|g})F$ Stat.					1.04

Standard errors in parentheses

* p< 0.10, ** p< 0.05, *** p< 0.01

All specifications include a time trend and newspaper and province dummy variables except for column (3), where newspaper dummy variables are excluded. Standard errors are robust against heteroskedasticity and clustered at the newspaper/province level. Excluded instruments for logit model are the average price of newspapers in the other region and the average price of newspapers in the same group in the other region. For the nested logit a variable that indicates whether there is a regional competitor in the province in the same group, and the average format of other newspapers is added as as instrument.

Table 6 Price Elasticities, Readers Demand, Flexible Model

	Own price	Cross Price	
		Same Group	Other Group
BVL	-1.47	0.108	0.011
DM	-1.27	0.206	0.008
DS	-1.16	0.322	0.012
FET	-1.78	0.218	0.008
GVA	-2.08	0.207	0.019
HLN	-2.11	0.791	0.042
HV	-2.63	0.190	0.011
NB	-2.34	0.589	0.030
DH	-2.52	0.468	0.015
LECH	-1.82	0.103	0.004
LLB	-1.16	0.175	0.007
LS	-0.96	0.378	0.015
SUD	-1.82	0.958	0.030
VA	-1.97	0.734	0.024

Cross price elasticities are for example in the first row $\frac{\partial q_j}{\partial p_{BVL}} \frac{p_{BVL}}{q_j}$. All elasticities are computed at the national level for the year 2004
Elite newspapers are printed in Italics.

Table 7 Markups Readers and Advertising Side; Flexible Model

	Mark-up in €		Profit per Copy Sold		
	Readers	Advertising	Readers	Advertising	Total
All Newspapers	-0.315	9,032	-0.315	0.588	0.273
Elite	-0.502	7,393	-0.502	0.935	0.433
Popular	-0.258	9,525	-0.258	0.483	0.225

σ_{elite}= .448; σ_{pop}= .761; $\alpha = -.982$
ε_{q^N}= 1.357;ε_{p^A}= −1.604

Table 8 Markups Readers and Advertising Side; Flexible Model Readers' side, FE Advertising

	Mark-up in €		Profit per Copy Sold		
	Readers	Advertising	Readers	Advertising	Total
All Newspapers	-0.514	11,965	-0.514	0.779	0.265
Elite	-0.819	9,793	-0.819	1.239	0.421
Popular	-0.422	12,618	-0.422	0.640	0.218

σ_{elite}= .448; σ_{pop}= .761; $\alpha = -.982$
ε_{q^N}= 1.285;ε_{p^A}= −1.211

Table 9 Change in Welfare

Efficiency Gains		ΔCS		ΔPS	ΔW
Read.	Ad.	Read	Ad.		
Flexible model readers' demand; no FE ad demand					
No	No	-1.14%	-1.66%	+1.69%	-1.12%
2%	No	-0.14%	-0.61%	+2.01%	-0.16%
2%	2%	+0.24%	+0.28%	+2.10%	+0.44%
Flexible model readers' demand; FE ad demand					
No	No	-1.15%	-1.61%	+1.64%	-1.35%
2%	No	+0.02%	-0.42%	+2.11%	-0.20%
2%	2%	+0.18%	-0.08%	+2.18%	+0.09%

Table 10 Merger Evaluation

	(1)	(2)
PostMerge × Merging	-0.0321	
	(.0155)	
PostMerge × Qual		-0.0224
		(.0157)
PostMerge × Dutch		-0.0494***
		(.0101)
Postmerge × Qual × Dutch		-0.0159
		(.0197)
N	384	672
Newspapers	8	14

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$