

Targeted Advertising: The Role of Subscriber Characteristics in Media Markets

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Abstract

This paper examines the extent to which targeted advertising can raise equilibrium advertising prices. I present a model of advertising which incorporates the role of targeting and consumer segmentation in determining advertising value. Using a detailed dataset of zip code level circulation for 840 daily newspapers in the United States, I show that newspapers facing more competition have *higher* advertising prices than similar newspapers facing little or no competition. This is despite the fact that newspapers in more competitive markets have lower circulation prices, indicating that there is a substantial competitive effect in at least one side of this two-sided market. I explain this result by showing that greater homogeneity in demographic characteristics, and lower geographic dispersion, allow newspapers to charge significantly higher advertising rates per reader. In other words, the results indicate that there exists a substantial benefit to advertisers and media firms from targeted advertising. I show that these results are driven by the fact that newspapers in more competitive markets are able to segment readers according to their location and demographics, thereby raising advertisers' willingness-to-pay for such readers.

JEL Code: L82, L41.

1 Introduction

In this paper I examine how media targeting can raise the value of advertising. I estimate the extent to which the price of print advertising varies as a function of observable characteristics of the subscriber base, and, in particular, the degree of homogeneity of these subscribers.

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I also provide a framework to understand how any advertising medium – print, radio, television or the internet – is dependent on efficiently reaching a core, target audience that maximizes the return to placing an advertisement in that medium.

The basis of this paper is the hypothesis that media which reach more concentrated or homogenous groups of consumers should be able, all else equal, to charge higher advertising prices than media reaching more diverse, heterogenous groups of consumers. Consider two hypothetical cities. In the first, there are two newspapers, each of which has roughly uniform sales in the various parts or neighborhoods of the city. In the second, there are also two newspapers but they reach very segmented groups of subscribers; for example, one has sales concentrated only in the north, and the other in the south of the city. Under fairly reasonable assumptions on consumer and advertiser behavior, it is possible to show that average advertising prices *per reader* will be higher in the second case. This result is not limited to geography; media that successfully segment their subscribers according to income, age, race, even political leaning, are likely to charge higher advertising prices, keeping constant the size of their circulation. In other words, media that are successful in targeting homogenous groups of consumers will be able to charge higher advertising prices. In this paper, I examine whether this phenomenon holds true in newspaper markets and attempt to quantify the extent to which it can be seen.

In general, advertisers should be willing to pay high premiums to have information about consumer characteristics, either because they can tailor their advertising content more specifically to smaller, sharply differentiated groups of consumers, or because they can choose exactly which groups to advertise to and which ones to ignore, thereby reaching a more preferred audience. The more information they have about the characteristics of the subscribers of a medium, the more valuable it is to be able to market their products to them, holding all else constant. Hence, the opportunity to advertise in a medium that reaches a large number of heterogenous consumers is less attractive than the opportunity to place multiple ads in smaller, better defined media.

Of course, I am not suggesting that *all* advertisers will value more homogenous groups of subscribers. Indeed, advertisers care most about reaching subscribers who will give them the greatest return on their advertising investment and, thus, may even be willing to see greater heterogeneity among subscribers if that leads to an increase in the advertiser's preferred demographic. A retailer selling products aimed at women would rather advertise in a market that is 50% male than 100% male. However, if the segmentation of a large market into smaller groups of homogenous consumers aids advertisers in concentrating their marketing dollars, then it will increase the aggregate demand for advertising, keeping all else constant, and this will be reflected in higher advertising prices in such markets. My hypothesis is not that every advertiser's willingness-to-pay for advertising will increase in

the level of homogeneity of the subscribers, simply that the market price will increase in this level of homogeneity.

The rewards to reaching a select group of homogenous consumers are quite apparent. Targeted advertising is becoming more ubiquitous, and not just in media markets. Increasingly, political parties and organizations are using sophisticated techniques to predict voting behavior, and hence target potential donors and supporters, based on purchasing behavior, church attendance, television viewership, or other characteristics of the population. Targeting is practiced by banks and credit card companies, who try to reach certain groups of customers based on their spending profiles, credit scores or other risk factors. And targeting is widely observed in the media, whereby advertisers place their advertisements in newspapers and magazines or on particular television and radio shows, to maximize the probability that the audience will be swayed by the advertisement to purchase the product. As more information about consumers becomes available, aided by additional segmentation provided by Internet usage behavior, the targeting of advertising in the media is sure to grow in importance.

Newspaper markets provide a natural way to examine the targeting of advertising because they have the advantage of providing complete, accurate data on the reading preferences of the population, as well as multiple dimensions along which readers are segmented into groups, such as location and demographics. Compared to broadcast media such as network television and radio, print media have a distinguishing characteristic in that these media charge a positive price for both sets of goods that they produce.¹ On the one hand this complicates empirical analysis of the problem, since newspaper publishers have two prices to set; this leads to complex interactions between the two markets, something which is not an issue for other media. On the other hand, this is actually a benefit for researchers since the sales data provide exact information on the quantity and location of newspaper consumption and therefore on the characteristics of the subscriber base. For radio, quantity data are usually based on estimates from diary records; and for television, Nielsen data often have credibility problems due to the possible unrepresentativeness of the sample. Besides, audience figures in these markets are estimates based on samples that make prior assumptions about viewing behavior by various demographic groups, while newspaper circulation data are audited measures of actual sales. For this reason, newspaper circulation data are probably superior for the analysis that follows of how segmentation and geographic dispersion affect advertising prices.

The results support the hypothesis that targeting groups of similar consumers is more valuable. While I do not have data on the characteristics of individual readers, or even

¹Television and radio stations distribute their programming content free of charge. Cable and satellite TV viewers, however, do pay a price for their service. Though even in this case, consumers usually pay for a package of television channels, rarely paying for the marginal channel or tv show.

average characteristics for individual newspapers, I am able to infer the *variation* in these characteristics using variation in the sales of newspapers across markets. The results show that advertising prices have a very clear and significant relationship with characteristics of the subscriber base. Specifically, various specifications of my baseline model show that newspapers with more ‘homogenous’ readers charge significantly higher advertising prices per reader. This homogeneity is defined according to a number of different characteristics—the degree of geographic dispersion of the subscriber base; and variation in demographics such as income, education and race. Therefore it appears that targeting a niche audience of subscribers can be profitable for media firms.

This paper adds to the literature on media markets in a number of ways. First, its focus on advertising prices rather than subscriber benefits fills an obvious gap; recent research has looked at the effect of media concentration on available variety (George and Waldfogel (2003) examine newspaper markets and Berry and Waldfogel (2001) look at radio markets) and at whether free entry leads to excessive entry in media markets (Berry and Waldfogel (1999)). Both these lines of research have looked at media markets from the point of view of readers or listeners rather than from the point of view of advertisers. Second, this paper has a potential policy implication in that it makes the case that all media firms should be treated as monopolists in advertising markets to the extent that their products are not just differentiated but mutually exclusive in terms of subscribers. This, along with the focus on the under-examined advertising side of the market, implies that answers to questions regarding total welfare and the optimal number of firms require much greater care than may be immediately apparent.

Further, this paper makes an important contribution to existing studies of newspaper markets.² I use detailed zipcode level data on circulation which provide a much clearer picture of competition than the aggregate data used in some previous work. The zipcode data dispel the notion, which is common in the literature, that most newspaper publishers are actually monopolists; while this may be true for the number of publishers in a city, more than half of all zipcodes in my dataset have at least two daily newspapers operating, with some having as many as 15. And it is precisely due to having such detailed data that I can make inferences about the underlying characteristics of subscribers, which would be impossible with aggregate data.

This paper is organized as follows. Section 2 reviews the literature on media markets and, in particular, newspaper markets. Section 3 presents a Hotelling-type model which demonstrates how it is theoretically possible for advertising prices per reader to go up when more media firms enter the market. Section 4 describes the data available for estimation.

²Some of the older papers include Rosse (1970), Dertouzos and Trautman (1990) and Thompson (1989). An example of more recent work is Gentzkow (2006). Chandra (2006b) surveys this literature.

Equilibrium in the advertising market is described in Section 5. The empirical formulation and results are presented in Section 6. Section 7 concludes.

2 Literature Review

There has been substantial work on media markets, and in particular the newspaper industry, some of which has been described above. For a comprehensive survey of the literature on advertising, see Bagwell (2007). There is a growing literature on media markets in the context of two-sided industries; recent examples include Kaiser and Wright (2004) and Chandra (2006b). This literature is surveyed in Anderson and Gabszewicz (2005).

There has also been recent (mainly theoretical) work examining targeted advertising or studying its effects on prices and competition. Most of this research has assumed that firms can directly target different groups of consumers, i.e. without considering the intermediary role of media. Hernandez-Garcia (1997) argues that most studies of targeted advertising assume that targeting increases efficiency. He shows that in a monopolistic framework, targeting of consumers with a low valuation of the good may reduce consumer surplus and even social welfare. A similar conclusion is reached by Esteban et al. (2001). Dukes (2004) shows that greater media differentiation can possibly lead to socially excessive levels of advertising.

On the other hand, Grossman and Shapiro (1984) show that an improved ability to target advertising increases the competitiveness of the market and causes prices of advertised goods to fall. Galeotti and Moraga-González (2004) find the opposite result- if firms are allowed to target distinct groups of consumers, their profits rise. Iyer et al. (2005) also show that, when targeted advertising is permitted, the equilibrium has firms advertising more to consumers that have a stronger preference for their product. This leads to less wasteful advertising, and higher profits for firms.

Among the few papers that incorporate the role of the media, Gal-Or and Dukes (2003) show that advertising prices can actually increase when media are less differentiated. This follows as a result of lower levels of information available to consumers and therefore higher margins for advertising firms. This result is counter to the model predictions and empirical results of my paper.

Turning to empirical work, to my knowledge there have been only two studies of the effect of readers' characteristics on advertising prices in print media, though neither one examines the role of reader homogeneity in these markets. Thompson (1989) uses data on British newspapers to estimate a relatively simple model of circulation versus advertiser appeal. The analysis primarily deals with the effect of having more affluent readers (who are therefore more valuable to advertisers) on circulation and advertising. The results

show that a firm can decrease its circulation but still increase advertising revenue, as long as the proportion of affluent readers increases. Similarly, Depken (2004) examines reader characteristics in US magazine markets. He finds some evidence that advertisers are willing to pay more for wealthier and older readers.

Goettler (1999) performs a very similar exercise to mine using data on television shows. While he also examines the optimal scheduling of these shows, he uses data on the expected demographic characteristics of viewers of individual shows to infer the value of particular demographic groups, as well as the value attached to viewer homogeneity. His results are intuitive; there is a clear premium for viewers in the much sought after 35-49 age group. Moreover, the results clearly show that greater homogeneity in age and gender are associated with significantly higher advertising prices per viewer. Interestingly, he finds that advertising prices are convex in the number of viewers; i.e. that a show with 20 million viewers is more than twice as valuable as a show with 10 million viewers. I discuss this point, and its relevance to the newspaper industry in more detail in Section 5.

The product level data on subscribers used by Goettler are extremely desirable for studying the effects of subscriber characteristics in advertising markets. Note, however, that similar data on average characteristics of newspaper readers are simply not available, at least not separately for all newspapers in the industry, and therefore must be inferred from the variation in aggregate data, which is what I do in the analysis below. Moreover, the newspaper data also allow me to identify the effect of geographic dispersion on advertising prices, which is not something that can be easily done in television markets; Goettler, for example, does not have data on the physical location of television audiences.³ He also does not have data on race, income or education – which I find to be useful explanatory variables in the newspaper market – since Nielsen did not provide information on these demographic characteristics for the years in his sample.

George and Waldfogel (2003) use zipcode level data on newspaper sales and demographics; their dataset is very similar to mine. However, they do not study advertising prices. Instead, they examine whether the tendency for individuals to purchase a product is sensitive to the distribution of preferences in a market. Their empirical strategy relies on using the variation in race distribution across zipcodes to identify the effect of race distribution on newspaper purchasing preferences. The results document how markets that are made up of large groups of distinct consumers exhibit a tendency for individuals to consume that increases in the size of their own group and decreases in the size of other groups. In par-

³It may not be very meaningful to examine the effect of geographic dispersion in the market for advertising in the national networks since these channels presumably have a far lower fraction of location-specific advertising than do local newspapers. An interesting avenue for research would be to study how much location-specific advertising is shown by local stations or affiliates especially as audiences become more geographically concentrated.

ticular, per capita newspaper sales among blacks in an MSA are increasing in the black population in that MSA and decreasing in the number of whites.

3 A Model of Advertising Pricing in Differentiated Media

The following model describes a market with differentiated consumers, and the value to advertisers from reaching consumers of a certain type. The differentiation can be geographic, in the sense of a spatial distribution of consumers, or along other dimensions such as demographic characteristics. Media firms could be newspapers, radio or television stations. It may help to think about the degree of differentiation, as outlined below, as physical distance. That is, potential advertisers would like to reach more valuable consumers, which in this case would be consumers who are closer in a geographic sense to the retail outlets of these advertisers. Therefore, the value from advertising declines, the further away the readers of the newspaper are. However this model can hold for more general cases as well.

Consider a model in which consumers of measure 1 are uniformly distributed on the line segment $[0,1]$. There is also a continuum of firms of measure 1 distributed uniformly along the same line segment. These firms are potential advertisers in the existing news or entertainment media. If a consumer at location θ sees an advertisement by a firm at location x then the probability that she will buy a unit of the firm's good is given by $p(\theta, x) = 1 - |\theta - x|$. Therefore the probability that the consumer buys from a firm at her very own location, conditional on seeing the firm's advertisement is 1.

The net return to any firm from a transaction with a consumer is given by v . Media firms set the price of advertising and can display any number of advertisements, though at a marginal cost $c > 0$. Note that in this model I abstract away from fixed costs of operating and thus the entry behavior of media firms; the objective is simply to focus on the effect on advertising prices as the market structure changes from a monopoly to a duopoly.

Case 1 *Single Medium*

First, consider the case with a single media firm in the market, reaching the entire mass of consumers. A potential advertiser at location x will be indifferent between placing an ad or not if

$$v \int_0^x [1 - (x - \theta)] d\theta + v \int_x^1 [1 - (\theta - x)] d\theta = p$$

where p is the price of one ad. So,

$$x = \frac{1}{2} \pm \sqrt{\frac{3}{4} - \frac{p}{v}}$$

This implies, that the media firm loses market share (of advertising) as the price increases, and gains market share as the value to an advertiser of reaching a given consumer, v , increases.

Therefore the monopolist's problem is

$$\max_p (p - c)2\sqrt{\frac{3}{4} - \frac{p}{v}}$$

and the optimal price is given by,

$$p = \frac{v}{2} + \frac{c}{3}$$

.

If $c > 0$, we get $x \in (0, 1)$ which implies that the monopolist will not sell to the entire market; i.e. some potential advertisers will choose not to advertise.

Case 2 *Dual Media*

Now consider the case where there are two media in the market operated by the same owner. Assume that Medium 1 reaches consumers located in the interval $[0, 1/2]$ and that Medium 2 reaches consumers located in the interval $[1/2, 1]$.

Now the value to an advertiser located at $x < 1/2$ from advertising in Medium 1 is

$$v \int_0^x [1 - (x - \theta)] d\theta + v \int_x^{1/2} [1 - (\theta - x)] d\theta = p$$

which implies that for the indifferent advertiser located at x ,

$$x = \frac{1}{4} \pm \sqrt{\frac{7}{16} - \frac{p}{v}}$$

The firm's optimal price for advertising at Medium 1 is p_1 to maximize

$$\max_{p_1} (p_1 - c)2\sqrt{\frac{7}{16} - \frac{p_1}{v}}$$

It can be shown that, in equilibrium, if $c > v/4$ then

$$p_1 = p_2 = \frac{7v}{24} + \frac{c}{3}$$

and not all firms choose to advertise.

If $c < v/4$ then the optimal price at each medium is

$$p_1 = p_2 = \frac{9v}{24}$$

and all firms choose to advertise.

To compare advertising prices in this case with the single media case discussed above, it is important to consider prices *per subscriber*. It is natural to expect that advertising prices go down as the number of subscribers decreases; the interesting question is whether the media firms can charge more for the more valuable consumers.⁴

For simplicity, let $c = 0$. We can then see that the advertising price normalized by circulation in the single medium case is:

$$p = \frac{v}{2}$$

In the dual media case it is:

$$\frac{p}{1/2} = \frac{3v}{4}$$

That is, in the second case the media firm can charge higher advertising prices per subscriber. This is because the two media segment the market and allow advertisers to appeal to more ‘valuable’ consumers.

This simple model shows that a greater number of media can increase targeting of consumers thereby making it more valuable, per consumer, to advertise in the differentiated media. This raises the question of what happens in competitive markets, i.e. when there are multiple media, under different ownership, competing for advertisers. Will the increase in segmentation provided by multiple media outweigh the competitive effects of firms competing for customers? To answer this question, I turn to the data.

4 Data

The data for this paper are drawn from a number of different sources. I use zip-code level circulation data from the Audit Bureau of Circulations (ABC), an independent, not-for-profit organization that is widely recognized as the leading auditor of periodical information in the US and many other countries. Potential advertisers in the print media use the circulation data provided by ABC as the basis for determining where to allocate their advertising dollars. The ABC data provide detailed information on the circulation of 840 US daily newspapers for the years 1995 and 1996. For each newspaper, I know all the zip codes in which it is present, and the number of copies sold (weekday and Sunday separately).

⁴Previous authors have shown that advertising profits or prices are directly proportional to the size of the audience. See, for example, Gabszewicz et al. (2004).

Because of the fine detail that this dataset provides, I am able to determine exactly which newspapers compete with each other and how intense that competition is. Aggregate data would not allow me to make these distinctions. My dataset does not consist of the entire set of US newspapers; I have left out some of the largest, national newspapers such as the New York Times and USA Today because the goal of the paper is to examine how local retailers place advertisements in newspapers that circulate in surrounding areas. I also do not include some newspapers on which ABC does not collect data, most of which tend to be very low circulation, small-town newspapers. Other than the national papers, the newspapers in my dataset are the major selling dailies, and the only ones on which ABC collects information.

Editor & Publisher magazine is my source of information on advertising rates, aggregate circulation, and other newspaper characteristics (such as the number of employees of the newspaper publisher and the number of pages per copy) for the same years. Editor & Publisher is the weekly magazine of the newspaper industry and it publishes an annual 'International Yearbook' with data on virtually every newspaper in the US. I have matched this information to the newspapers in the ABC database. Finally, I extracted data from the US Census of 2000 that matches to each zipcode detailed demographic data: race composition, median income, education distribution and population.⁵

Summary Statistics of the data are in Table 1. For the circulation figures, each observation is a newspaper-zipcode-year combination. The firm level statistics contain data from Editor & Publisher along with measures of segmentation and geographic dispersion, derived from demographic data, that I describe in the next section.

The considerable heterogeneity among newspaper publishers leads to some issues regarding the data. Foremost is the problem of establishing a criterion to measure the actual quantity of papers sold; newspapers can either be morning or evening editions (some are printed at both times, or even throughout the day). Not all newspapers publish on Saturdays or Sundays, and some of the smaller newspapers do not have editions on one or more weekdays either. I tried using total weekly circulation as the measure of a firm's output and market share. However in a number of cities, newspapers that compete during the week publish joint Sunday editions, which complicates using weekly circulation as a measure of output. On top of this, there are a few markets where two newspapers have Joint Operating Agreements or where multiple newspapers are owned by the same parent company, or where advertising is sold jointly for multiple firms and individual rates are not available. To deal with these issues I only use daily circulation and daily advertising

⁵The Census does not actually provide data on zipcodes; instead it uses its own geographical definition called the Zip Code Tabulation Area (ZCTA). The correlation of zip codes to ZCTAs is almost 100%, however a small fraction of actual zip codes are missing.

	Mean	StDev	Min	Max
<u>Newspaper-zip-years (189271 obs)</u>				
Daily Circ.	951.2	1803.2	1	39909
Sunday Circ.	1087.2	2089.8	0	22981
<u>Zipcodes (27151 obs)</u>				
Adult Population	7522	10029	6	91891
Fraction Non-Hispanic White	0.82	0.23	0	1
Median Income	40904	16004	2499	200001
Fraction 65+ years	0.19	0.08	0	1
Fraction College Degree	0.19	0.14	0	1
Fraction Male	0.49	0.04	0	1
<u>Newspaper-Years (3356 obs)</u>				
Year	1997	1.6	1995	1999
Daily Circ (Aggregate)	53645.7	96976.2	2147	1078223
Median Dist. from Pub. Zip (km)	11.3	9.3	0	100.8
Mean Dist. from Pub. Zip (km)	17.1	12.5	0.8	132.2
Other Firms (MSA only)	2.3	2.9	0	12
Ad. Rate (daily)	43.2	65.8	5	647.8
Pages	35.1	20.6	8.5	249
Fraction Non-Hispanic White	0.80	0.17	0.05	0.98
Median Income	40917	9664	22459	95518
Fraction 65+ years	0.18	0.04	0.06	0.41
Fraction College Degree	0.21	0.08	0.07	0.66
Fraction Male	0.48	0.01	0.43	0.59
Ad rate per 10000 readers	10.44	4.27	2.14	39.23
Retail Establishments	109.4	37.1	9.7	362.2

Table 1: Summary Statistics

Deciles of competitive index	Mean advertising rate per 10000 copies	Mean single-copy prices
1	12.586	0.464
2	11.964	0.484
3	10.854	0.500
4	10.626	0.509
5	10.038	0.519
6	9.104	0.530
7	9.375	0.560
8	9.360	0.564
9	8.287	0.580
10	8.978	0.564

Table 2: Newspaper prices by deciles of competitive index

rates as measures of quantity and price, ignoring weekend circulation and prices.⁶ I have included a dummy for whether the newspaper publishes in the evening in the regressions. I re-estimated all the regressions dropping markets where newspapers have joint operating agreements or common ownership and found results that were were virtually unchanged, whether I used daily or weekly circulation.

I use these data to derive some simple results to motivate the empirical section and to show that greater competition does not necessarily imply lower prices in advertising markets. Table 2 shows the relation between the level of competition faced by various newspapers in my dataset, and prices. To define competition, I create a measure that takes into account the number of competing newspapers in a given newspaper’s general circulation area. This measure, defined as a newspaper’s Weighted Herfindahl index (WH), also takes into account the intensity of competition that newspapers face. In each zipcode, I compute the Herfindahl index, based on the daily market shares (of circulation) of newspapers in the zipcode. Then, for each newspaper, I take the average herfindahl index in all the zipcodes where it circulates, weighted by its circulation in each zipcode. Therefore, for newspaper p ,

$$WH_p = \frac{\sum_r \left[circ_{pr} * \sum_q s_{qr}^2 \right]}{\sum_r circ_{pr}}$$

where r denotes zipcodes and q denotes the generic newspaper in a zipcode.

⁶This is unfortunate since Sunday advertising rates usually differ from weekday rates due to different circulation, and so if it had not been for the Sunday joint editions, I could have also used the additional variation in Sunday prices and quantities to estimate the model.

The first column of Table 2 ranks the deciles of this competitive index, where newspapers with the lowest values of OWH , that is the newspapers facing the most intense competition, are in the first decile and so on. The second column contains the mean daily advertising price per 10,000 readers for each decile of newspapers. Clearly, there is a negative relationship between the competitive index and advertising prices normalized by circulation. While the relationship is not monotonic, it is quite apparent that newspapers with more competitors and therefore with lower market shares (of circulation), have higher advertising prices. Advertising prices decline as newspapers face less competition. This seems to support the segmentation hypothesis: that markets with more newspapers tend to segment the readership into distinct groups and this leads to greater value from advertising to these groups.

The third column contains the mean circulation price for each decile of newspapers. There is an obvious positive, and almost monotonic, relationship between circulation prices and the competitive index; newspapers facing less intense competition tend to have higher circulation prices. This implies that there are indeed competitive effects of rival newspapers. Presumably, this competitive effect is present in advertising markets too. However the results of the second column seem to suggest that the rise in advertising prices due to the segmentation effect outweighs any possible decline in prices due to competition. It appears, therefore that newspapers are efficient at targeting newspaper readers by positioning their products in such a way as to appeal to distinct audiences.

It is important to note that the data used to derive all of the results in this paper—both the circulation figures and the demographic variables—are means or totals at the zip-code level. Therefore, any inference regarding the effect of demographics on advertising prices relies on variation in these mean values, as well as the correlation of these means *across* zipcodes. These measures mask the variation *within* zipcodes which, presumably, is substantial. If data were available on the newspaper purchasing choices and demographic characteristics of individual readers, I would expect much stronger and more significant relationships between demographics and advertising prices. Failing that, data on mean characteristics of readers at individual newspapers would also be extremely valuable. However, such data are unavailable to the researcher. While advertisers do have access to better data, they are usually responses by readers to surveys, and that too for the small subset of newspapers at which a given advertiser considers placing ads. Compiling a comprehensive database of individual level data for all newspapers, or even for a representative sample of newspapers is not feasible. In electronic media – such as cable or satellite television and on the internet – the potential for knowing individual level data on subscribers, or even mean characteristics at individual media firms, is much greater. See Goettler (1999) for one such study.

5 The Model: Determining the Price of Advertising

In this section I describe equilibrium in the advertising market and develop a model that can be used to estimate the effect of subscriber characteristics in advertising markets.

5.1 Advertiser demand

I first model the ad purchase decision by retailers. While it may at first seem natural to assume that advertisers view different newspapers as (imperfect) substitutes, the degree of substitutability depends on newspaper readership; in particular, the extent of overlap among rival newspapers. To the extent that there is no overlap of readers across newspapers, every newspaper is a monopolist with regard to its circulation base. In the market for local newspapers in the US, a reasonable assumption is that consumers purchase at most one local newspaper. This is an assumption used to motivate the discrete choice model of Chandra (2006a). As discussed in that paper, the data support the notion that consumers rarely buy multiple papers at the local level. In this context the circulation of the national dailies (which may well be bought along with a local paper) can safely be taken as given. For a given newspaper, then, there is a certain value to placing an advertisement in it: this value is a function of the number of readers; their characteristics such as location and demographics; the probability that they see the advertisement; and the expected profit that the firm makes from their purchase of the advertised product. If this value exceeds the advertising price, the advertisement should be placed, regardless of prices in other newspapers. There is nothing stopping potential advertisers from advertising in multiple papers, as long as the return they derive from their advertisement exceeds the price that they pay at each paper.

In practice, firms may face credit constraints that prevent them from borrowing to advertise in anticipation of future profits, or they may be forced to operate within an advertising budget for other reasons. If that is the case, then newspapers can no longer be viewed as monopolists in the advertising market, and price competition will ensue. In the empirical work I include controls for the number of rival firms of each publisher to check for this possibility.

I now define the benefit or ‘utility’ that an advertiser receives from placing an advertisement in a given newspaper. It is important to note that this utility is derived from the advertisement being seen in a number of markets, each with its own characteristics.⁷ The advertiser has information on the different markets and thus computes the return from the ad being seen in each market. Let $S\{i\}$ be the set of markets where newspaper i circulates,

⁷The term ‘markets’ here could imply different cities, counties or metropolitan areas- essentially the smallest geographic level at which circulation information is available. In the empirical work I define each zipcode to be a separate market.

and for all $k \in S\{i\}$, let q_{ik} be the number of subscribers of i and X_k be demographic characteristics of the population, such as household income, which is not advertiser specific. Then, in market k , the utility to retailer j from advertising in medium i is:

$$U_{ijk} = f(N_i, q_{ik}, X_k, D_{kj}),$$

where N_i is a newspaper specific term which denotes the value of an advertisement in newspaper i that is independent of the characteristics of its circulation; for example, the probability that a given advertisement is seen by the newspaper's readers. D_{kj} is a market-advertiser specific term which captures the value that advertiser j derives from reaching readers in market k .

The total utility that j receives from placing an advertisement in newspaper i is then

$$U_{ij} = \sum_{k \in S\{i\}} U_{ijk}$$

Later, I will adapt this model to account for differing returns to size in advertising but for now, focus on the utility from an ad of a unit area. Infact, the term 'utility' is a misnomer in this description, since firms which place advertisements are maximizing profits and therefore U_{ij} should be understood as the net profit that the firm makes from sales that arise as a result of placing the ad. However to preserve the analogy with consumer theory, as advertisers are essentially purchasers of space in the medium and therefore 'consumers' in that sense, I will refer to this term as utility.

Conditional on the expected characteristics of the readers of the newspaper, the return to an advertiser is linear in the number of readers. That is, the value of reaching two readers with the same expected characteristics is exactly twice the value of reaching one reader with those characteristics. While this assumption abstracts away from the cost structure of advertisers, it is a realistic representation of newspaper ad pricing- prices are commonly quoted as the rate per thousand readers, i.e. it is assumed that the total price, and therefore the total value, is proportional to the number of readers.⁸

This assumption can be written as,

$$U_{ijk} = \bar{U}_{ijk} * q_{ik},$$

where

$$\bar{U}_{ijk} = g(N_i, X_k, D_{kj})$$

The function \bar{U}_{ijk} , then, is a measure of the utility to the advertiser from reaching one

⁸I say that it abstracts away from the cost structure because with decreasing returns to scale every additional customer is less valuable than the last one. With constant marginal cost this is not an issue.

reader in market k with expected characteristics X_k . I represent this function as

$$\bar{U}_{ijk} = X_k^\alpha D_{kj}^\beta N_i^\eta$$

Here, D_{kj} is a measure of the distance from advertiser j to market k . N_i is defined as the number of pages in newspaper i . I expect $\alpha > 0, \beta, \eta < 0$. The advertiser derives more value from reaching readers that are closer in the sense of physical distance and who have greater income. The number of pages is representative of the probability that the reader actually notices the advertising; more pages imply a lower probability.

Note that the advertiser's utility is not dependent on characteristics of the newspaper such as quality, editorial content or political leaning. This is because the utility is directly a function of the number of newspapers sold. Conditional on this number, the only newspaper-specific characteristic that advertisers care about is the probability that their advertisement is actually seen.

Incorporating all these we finally get,

$$U_{ij} = N_i^{-\eta} \sum_{k \in S\{i\}} X_k^\alpha D_{kj}^{-\beta} q_{ik}$$

Having specified the value to an advertiser from placing an advertisement of unit size, I now turn to the advertiser's optimization problem: How much advertising to purchase.

Let the representative advertiser, j , choose the size of an advertisement in medium i that maximizes utility net of costs. That is

$$\max_a U_{ij} a^{\gamma_1} - p_a a^{\gamma_2} \tag{1}$$

with $0 < \gamma_1 < 1$ and $\gamma_2 > 0$. Here a is the quantity of advertising and p_a is its price per unit area. I define U_{ij} as being the return to placing an ad with an area of one column inch (the standard unit of measurement in print media). The total return from the ad is increasing in its size, but at a decreasing rate. The price per column inch is p_a and the total cost of the ad is also increasing in size. The γ_2 parameter captures what Busse and Rysman (2005) call the 'curvature' of the price schedule. γ_2 is expected to be less than 1, reflecting quantity discounts (i.e. that a full page ad costs less than two half page ads) but there is nothing in the model that prevents it from being greater than 1, which would imply a price premium for larger advertisements. Note again that this formulation of the advertiser's problem ignores prices at other media, which follows from my argument above of how each publisher can be treated as a monopolist in the advertising market. To be complete, the advertiser's problem is actually to choose the optimal amount of advertising at each available newspaper.

For this problem to have a solution we obviously must have $\gamma_2 > \gamma_1$, i.e. the curvature of the price schedule is more than that of the return to size from larger ads; otherwise the advertiser chooses an infinite amount of a .

The solution to the maximization problem in (1) is given by⁹

$$a = \rho U_{ij}^\theta p_a^{-\theta} \quad (2)$$

where ρ is a constant and $\theta = \frac{1}{\gamma_2 - \gamma_1} > 0$.

In the empirical section I focus on the effect on prices *per reader*. To express the advertising demand in terms of this variable, equation (2) can be rewritten as

$$a = \rho \bar{U}_{ij}^\theta R^{-\theta}$$

where $R = \frac{p_a}{q}$ is simply the rate per reader.

5.2 The Publisher's optimization problem

Modeling the supply-side naturally depends on prior assumptions on the nature of competition in this industry. However, whether we believe the market is competitive, or that individual newspapers set prices ignoring the actions of other publishers, there is still a straightforward relationship between prices and consumer characteristics. These characteristics can be thought of as essentially demand shifters.

In a competitive market, equilibrium can be defined by straightforward supply and demand relationships between the price of advertising and the number of advertisements sold. Denoting the price of ads by p and the quantity by a , the supply of ads can be written as

$$p = f(a, Z)$$

where Z contains exogenous variables affecting supply such as costs. Similarly the demand for advertising takes the form (similar to the relationship derived above):

$$a = g(p, X)$$

where X contains exogenous variables affecting demand such as characteristics of the reading population, the number of potential advertisers, etc.

Combining these two equations, the reduced form relates equilibrium prices to demand and supply shifters,

⁹The way the model is set up, no matter what the values of U and p_a , the solution to this problem is a positive, albeit infinitesimal. This implies that *all* advertisers will choose to advertise in *every* newspaper. This can easily be remedied by constraining a to be ≥ 1 i.e. all advertisements must be at least one column inch in area.

$$p = h(X, Z)$$

That is, the reduced form characterization represents a causal relationship between market characteristics and prices. In particular, characteristics of readers can be expected to shift the demand for advertising and hence equilibrium prices as well.

However, as argued above, the publisher should act as a monopolist in the advertising market. This implies a similar relationship, though via different reasoning; there is no ‘supply curve’ for a monopolist, instead the publisher equates marginal revenue to marginal cost and sets the corresponding price.

$$\max_{p_a} p_a \cdot a - c \cdot a \tag{3}$$

where c is assumed to be the constant marginal cost of printing an advertisement of unit area. The constant marginal cost can also include the loss in revenue from slightly decreased circulation or the gain from slightly increased circulation, depending on whether consumers value advertising positively or negatively. I do not address this issue further here since it is addressed in Chandra (2006a). However, it is worth pointing out that both Rosse (1970) and Dertouzos and Trautman (1990) find that consumers do not derive any disutility from advertising.

The first order condition for (3) implies that

$$a + p_a \frac{\partial a}{\partial p_a} = c \frac{\partial a}{\partial p_a}$$

Using the expression for a developed from equation (2) and substituting $p_a = Rq$, we get

$$R = f(U_{ij}) = f(N_i, X_i, D_i) \tag{4}$$

That is, the equilibrium price per reader is a function of observable characteristics of the subscriber base, and characteristics of the newspaper. This is an estimable relationship between prices and characteristics of the newspaper’s circulation. Therefore, whether the advertising market is competitive, or whether the publisher has monopoly power in this market, it is possible to derive an estimable relationship between advertising prices and readers’ characteristics. In the empirical work I will include controls for the firm’s competitive environment to determine if the number of other newspapers in the market has any effect on advertising rates.

Note that this model is consistent with an explicit two stage model of a publisher’s profit maximizing behavior where, in the first stage, the publisher sets newspaper characteristics

and newspapers compete for circulation, and in the second stage advertising prices are set so as to maximize profits taking into account that the demand for advertisements is a function of the number and characteristics of the readers that newspapers captured in the first stage. This is also consistent with making long run investments in fixed assets such as editorial staff, reporters and printing capacity as well as long term image or political leaning. Under this hypothesis, firms set the characteristics of the paper so as to be able to maximize circulation; a higher circulation is always more profitable in the second stage. The pricing data do lend support to this hypothesis: newspapers have typically been shown to price well below the marginal cost of printing, newsprint and ink, with the vast majority of newspapers pricing at either 25 or 50 cents per copy.¹⁰ This appears to support the reasoning that publishers price as low as possible in the first stage so as to maximize circulation for the second stage, though it is also not inconsistent with other models of competitive behavior.¹¹ Moreover, the data show that circulation prices are very sticky and usually revised by the firm every few years; while advertising prices are adjusted regularly, usually every year or even more often, depending on the frequency of circulation audits.

6 Results

In this section I discuss the empirical formulation that will be used in the estimation of Equation 4 and present the regression results.

6.1 Empirical Specification

As claimed before, a newspaper's ability to segment its readers, or to be able to draw readers with similar characteristics should result in its being able to charge a higher advertising price. A paper with a varied, heterogenous readership base dilutes the value to advertising for potential advertisers who would like to be able to target groups that are most likely to purchase their product. Therefore, it is necessary to develop a measure of reader homogeneity, or, alternatively, of the extent to which newspapers segment readers into particular groups.

Segmentation can occur along many dimensions. An obvious way that newspapers segment markets is geographically; by appealing to distinct geographic regions of a city or metropolitan area, these papers then become attractive advertising media for retailers who want to reach consumers that are located close to them. However, segmentation can also

¹⁰Note that prices do not fall to zero; advertisers are interested in their ads being seen by readers, and a positive price ensures that the newspaper is actually read by consumers. While free newspapers do exist, I do not have data on them and to my knowledge their circulation is neither audited nor verifiable.

¹¹See Rosse (1970) for a discussion of how a quantity setting game can lead to circulation prices that are below marginal cost. This applies to the monopoly case, however.

take place along demographic characteristics such as race, income and education. If advertised products appeal to distinct groups according to one or more of these characteristics, then advertisers should be willing to pay more for advertising in newspapers that reach such audiences. In related work, George and Waldfogel (2003) have shown that newspaper reading preferences increase in the number of people in the same group that read that paper, especially when groups are defined according to race. This suggests that demographic characteristics are useful predictors of reading preferences and potentially also a means of targeted advertising.

Ideally, with individual level data on the demographics and location of subscribers, it would be straightforward to compute the degree of homogeneity of any given newspaper's readers. However, such individual level data do not exist. Therefore, to look at the consequences of such segmentation on advertising prices, I exploit the variation in the aggregate demographic characteristics of the markets served by various newspaper firms.

To find an appropriate measure of reader homogeneity, it is useful to think about what causes a newspaper to have a certain audience. The segmentation of readers according to location or demographics may be a result of product positioning by newspapers or subscribers' self-selection or, more likely, a combination of both. In any case, if a paper's audience is well segmented along a certain dimension, say race, then it should be fairly easy to use variation in race to predict variation in the newspaper's circulation. If variation in the fraction of the population that is white is a good predictor of percapita circulation, it is an indicator of greater homogeneity in reader characteristics. Therefore the extent to which per capita circulation is predicted by race or other demographics indicates the extent to which the reading population is segmented along the corresponding dimension. This suggests that a simple correlation measure should serve the purpose of measuring segmentation. For the k markets in which newspaper i circulates,

$$s_i = |corr(x, m)|$$

where

$$m_k = \frac{q_{ik}}{pop_k}$$

is the per capita circulation in zipcode k . As should be apparent, the correct measure is to use the absolute value of the correlation; either a highly positive or highly negative correlation implies that circulation is strongly related to the corresponding demographic measure. Clearly, the correlation measure can take any value between 0 and 1; the higher the value of the correlation, the better the predictive power of demographics and the more homogenous the reading population, while values closer to zero imply that demographics do not predict circulation too well.

In the regressions that follow, I will use the correlation variable as the measure of reader homogeneity. Therefore it is important to understand the predictive power of this variable, as well as the way it enters the regression specification. One possible objection to using the correlation measure of segmentation as an explanatory variable would be that it is not ‘exogenous’ from an econometric standpoint. That is, since newspapers can choose which zipcodes to enter, they can effectively choose their most desired target audience, and therefore the measure of reader homogeneity based on demographics may be higher or lower for certain kinds of newspapers.

However, recall that I am not modeling the entry behavior of firms. I acknowledge that newspapers do have the power to appeal to, and be read by, their preferred readers. However, the point of this paper is to examine how their success in reaching their desired audience translates into higher advertising prices via the willingness-to-pay by retailers. In the extreme case, it may be possible that newspapers are completely efficient at selecting their most preferred readers. In that event, we may expect demographics to be perfectly correlated with circulation, and we may be concerned that there may be insufficient variation in the segmentation measure to identify its effect on advertising prices. However, as I show in Table 3, this is not the case.

The table shows the extent of variation in the correlation measure defined above. The figures are the absolute value of the correlations between per capita readership and the corresponding demographic. These demographic measures are defined as follows: Race- the fraction of the zipcode’s population that is Non-Hispanic White; Income- Zipcode Median Income; Education- the fraction of adults with a college degree; Age- the fraction of adults who are age 65 or older; Gender- the fraction of adults who are male; Distance- the zipcodes distance from the newspaper’s publishing office. Finally, the last line of Table 3 combines all of these demographic variables. This is done by regressing, for each newspaper, its readership per capita on the demographic variables described above, across all the zipcodes in which it circulates, and then taking the square root of the R-square of each regression.¹² This requires dropping some newspapers which circulate in very few zipcodes. Since a handful of newspapers circulate in a very small number of zipcodes, some in as few as 3, these papers would not have enough degrees of freedom to meaningfully estimate the regression described above using 6 demographic variables. I have dropped newspapers circulating in fewer than 9 zipcodes in order to calculate values in the last line of Table 3.

All the correlation measures show considerable variation. In particular, the measures take values very close to zero, implying that there are newspapers for which demographics have no power to predict circulation, as well as values very close to 1, implying that there

¹²Recall that the square root of the R-square of any regression is exactly the same as the correlation between the dependent variable and the predicted dependent variable using the estimated regression coefficients.

	5%	25%	50%	75%	99%	Mean	N
Segmentation:							
Race	0.017	0.093	0.195	0.325	0.853	0.232	3356
Income	0.022	0.101	0.215	0.366	0.769	0.253	3356
Education	0.026	0.116	0.237	0.398	0.802	0.274	3356
Age	0.017	0.087	0.194	0.336	0.831	0.239	3356
Gender	0.017	0.085	0.179	0.310	0.769	0.219	3356
Distance	0.200	0.437	0.576	0.703	0.916	0.558	3356
All	0.372	0.607	0.739	0.853	0.986	0.713	3225

Table 3: Correlation of demographics with per capita circulation: selected percentiles

are newspapers for which demographics are excellent predictors of circulation, as well as the entire range of values in between. Clearly, the distance measure is the single best predictor of circulation; even at the 5th percentile, there is a 20% correlation between distance from the newspaper’s publishing office and per capita readership. Of the demographic variables, education is the best predictor of circulation, while gender is the worst.¹³

Unsurprisingly, when combining all the demographic variables, the correlation measures are much higher. Using this measure, almost half the newspapers in the sample have a correlation of at least 75%. In theory it is possible to use many more demographic variables to try to predict circulation more precisely, however in practice increasing the number of explanatory variables decreases the number of available observations, as described above. For example, I have tried to use the fraction of the population in various other age categories, the fraction without a high school degree, the fraction below the poverty line or within various income categories, and the fraction in other race categories. The correlations using these variables are very similar to the values already reported, therefore in the interest of retaining as many observations as possible, I have employed an economical list of demographic characteristics.

I now examine whether markets with more newspapers exhibit increased segmentation,

¹³This is driven by the fact that there is simply less variation in the gender distribution across zipcodes than in the education distribution.

	Correlation with seg. measure	Significance Level	N
MSA Herfindahl Index	-0.166	99%	1324
MSA Number of Papers	0.174	99%	1324
Newspaper Weighted Herfindahl	-0.208	99%	3225

Table 4: The relation between competition and segmentation

i.e. whether newspapers in such markets have more homogenous readers. Recall that this could be one explanation for the results of Table 2 which implied that markets with more newspapers had higher advertising prices. In order to quantify homogeneity, I use the R-square measure described above. I examine three statistics: The correlation between the Herfindahl Index in an MSA and the average R-square of all the newspapers circulating in that MSA; the correlation between the number of newspapers circulating in an MSA and the average R-square of these papers; and the correlation between the weighted herfindahl index at each newspaper (described above) and its R-square measure. The results are shown in Table 4. The first two correlations have one observation per MSA per year, while the third has one per newspaper per year. All three correlations suggest that newspapers in more competitive markets have more homogenous readers. Note that the correlation values do not imply the direction of causality; it may be, for example, that markets with homogenous readers do not attract entry. However the correlations are consistent with the results shown in Table 2 that markets with more newspapers have higher advertising prices, since they suggest that these markets segment readers into distinct groups. Note also that all three correlations in Table 4 are highly significant. The magnitudes are moderately high; however, as discussed above (in Section 4) these values are derived from means at the zipcode level, and would probably be substantially larger if reader-level data were available.

Segmentation of readers according to demographics may be one way by which advertisers are able to target consumers. Another may be reader homogeneity defined according to the location of these readers. To the extent that retail advertising is placed by local establishments, retailers may not value having the paper dispersed over a wide geographic area as this would dilute the impact of advertising. That is, for a given circulation, advertisers would rather see readers located in a dense, concentrated area rather than in a dispersed, wide-ranging area. To measure geographic dispersion I calculate, for each zipcode in which a newspaper is present, its distance from the the newspaper's home zipcode. This is defined

as the zipcode where the newspaper's publishing office is located.¹⁴ I then calculate the standard deviation of the various distances for each of a newspaper's zipcodes, weighted by the paper's circulation in each zip. This is the same as the standard deviation measure defined above. Distance is calculated using data on the latitudes and longitudes of the centroid of each zip code as provided by the U.S. Census Bureau.

It is also useful to to measure the competitive nature of each firm's market and to examine whether competing firms drive down prices. The market itself, though, is not easily defined. One option would be to count all the firms in the MSA- the problems with this are that this obviously restricts attention only to firms in MSAs, as well as that multiple newspapers can exist in an MSA without being in direct competition with each other. Another alternative would be to simply count the number of firms in which each newspaper comes into contact- i.e. the total number of newspapers that overlap with its given circulation area. Again, this takes no account of the extent to which competing newspapers actually serve as substitutes for advertisers, since newspapers could overlap in markets despite market power being very high for one firm. The measure that I use is constructed as follows- for each newspaper I identify the base MSA as the one where its circulation is the highest. There is rarely any ambiguity in this exercise; for example, The Birmingham News circulates in 9 of Alabama's 12 MSAs (as well as a number of non-metropolitan zip codes), but over 90% of its circulation is concentrated in the Birmingham MSA. Next, for each newspaper I count the number of competing firms which share the same base MSA- this is the number of firms that I use in the regressions below. This ensures that I count among a newspaper's competitors only those firms which share the same primary market and whose circulation and pricing decisions are most likely to affect the newspaper's own price.

Note that estimation does not require the use of quantity data on advertising since the reduced form eliminates this variable from the analysis. A testable implication of the model, though, is that newspapers with higher circulation print more advertising- a standard result since an increase in circulation shifts out the demand curve and therefore the monopolist's marginal revenue curve, and implies higher quantity. I have advertising data on a subset of the firms in my sample and find a strong positive correlation between circulation and the number of column inches of advertising printed.

6.2 Regression Results

Table 5 provides a first look at the results of estimating equation 4. The dependent variable

¹⁴I also tried defining the home zip as the where the newspaper has its highest per capita circulation. The difference between the two measures is very small- publishing offices are usually located in or close to the areas where the newspaper has its most dense circulation.

	(1)	(2)	(3)	(4)	(5)
Number of Firms	0.014 [5.72]	0.013 [5.42]	0.014 [5.73]	0.013 [5.54]	0.015 [6.47]
Retail Establishments	-0.001 [4.15]	-0.001 [3.77]	-0.001 [3.95]	-0.001 [4]	-0.001 [4.91]
Fraction White	-0.051 [1.11]	-0.075 [1.62]	-0.066 [1.45]	-0.066 [1.44]	-0.017 [0.38]
Median Income	-0.001 [0.91]	0 [0.46]	0 [0.47]	-0.001 [0.7]	0 [0.1]
Pages	-0.007 [20.71]	-0.007 [21.16]	-0.007 [20.97]	-0.007 [21.1]	-0.006 [17.78]
Distance Std Deviation	-0.003 [7.24]	-0.003 [7.37]	-0.002 [6.98]	-0.002 [7.01]	-
Race Segmentation	0.203 [6.35]	-	-	-	-
Income Segmentation	-	0.122 [4.09]	-	-	-
Educ. Segmentation (<12)	-	-	0.175 [6.01]	-	-
Educ. Segmentation (College)	-	-	-	0.155 [5.36]	-
R-square (1st stage)	-	-	-	-	0.352 [13.33]
Constant	2.532 [47.05]	2.557 [47.42]	2.53 [46.81]	2.545 [47.29]	2.271 [42.15]
Observations	3206	3206	3206	3206	3206
R Square	0.268	0.263	0.267	0.265	0.285

Note: T-Statistics are in brackets

Table 5: Regression of log advertising rate per 10,000 readers

is the daily advertising rate per 10,000 copies sold. The distance measure is the standard deviation of the distance, in kilometers, of the median zipcode from the newspaper’s publishing office zipcode. The first four columns provide estimates using the correlation measure of segmentation, according to race, income or one of the two education levels—the fraction of the population with less than a high school degree, and the fraction with a college degree or higher. Clearly, no matter which measure is used, there is a strong and significant relationship between the segmentation measures and advertising rates per reader. For example, a ten percentage point increase in the correlation of the fraction white with per capita circulation is associated with an increase in advertising rates of around 2%. Each segmentation measure is significant at the 99% confidence level. Other correlation measures – according to age, gender and Hispanic status – showed similar results and have not been reported. The distance measure has a strong negative relation to advertising rates as well, confirming the hypothesis that, controlling for circulation, newspapers that are more dispersed have lower advertising rates. The number of pages in the newspaper has a negative and strongly significant relation with advertising prices; on average, an additional 10 pages in a newspaper reduces advertising rates per reader by 7%.

So far, I have used the various measures of segmentation separately. However, the optimal technique would involve combining all of these measures. To achieve this, I simply regress per capita circulation in each zipcode on all the demographic and geographic variables available, and use the fit of that regression as the measure of reader homogeneity. The regression is:

$$m_{ik} = \beta_0 + \beta_1 \text{FractionWhite}_k + \beta_2 \text{Income}_k + \beta_3 \text{Education}_k + \beta_4 \text{Dist}_{ik}$$

This is simply an extension of the logic above; newspapers with an extremely homogeneous subscriber base should have a substantially higher R-square from such a regression than newspapers with a more varied, heterogenous audience.

The fifth column of Table 5 includes the R-square from the first stage and omits the demographic variables. Clearly, the coefficient on R-square measure is positive and highly significant. The fit of this regression is better than the previous specifications as well. The results suggest that an increase of 10 percentage points in the first stage R-square leads to an increase in the advertising price per reader of around 3.5%. Note that the coefficient on the first-stage R-square is considerably higher than the coefficients on the individual correlations. This is to be expected, as the R-square contains all the information of the individual correlations.

These regressions have simply pooled the observations of all firms in each of the four years, allowing for separate year intercepts. To better exploit the panel structure of the data, I now perform fixed effects regressions. However it is important to note that including firm

fixed effects (the within estimator) would not yield meaningful results. Because demographic data do not change over time, the only within-firm variation in the explanatory variables comes from zipcode entry and exit by firms and is too small to provide any identifying power.¹⁵ However, the between estimator, which averages variation across time and relies solely on variation between firms, can be used to examine the same relationship as above. The results are shown in Table 6. The standard errors are naturally larger than before because there is effectively only one observation per firm, but the general magnitudes and signs of the coefficients are similar to the pooled case.

The positive sign on the number of firms may seem surprising at first glance but it should be noted that this is also the one variable that is clearly endogenous in the regression. The regression does not yet account for unobservable effects that may cause advertising prices and the propensity to read newspapers to be correlated, which would then naturally imply an upward bias to the coefficient on the number of firms. The means of the demographic variables do not control for this possibility since they are at the zipcode level, not at the level of the overall market. Therefore it is important to control for market level characteristics which is what I do next.

Table 7 includes market fixed effects in the regressions which accounts for unobserved heterogeneity across markets, but common among firms in the same market (MSA). As can be seen, the magnitudes and significance of most of the variables are qualitatively the same, with the exception of the number of firms. Now this variable is statistically indistinguishable from zero; suggesting that unobserved characteristics that lead to more firms in a market also lead to more value to advertising to readers in such markets. The insignificant coefficient on the number of firms also lends credence to the hypothesis that competing firms should not have any effect on each firm's advertising price.

To summarize the results of this section, I have shown that newspapers with more homogenous subscribers charge higher advertising prices, holding constant newspaper characteristics as well as market fixed effects. The results suggest that an increase of 10 percentage points in the predictive power of demographics on circulation are associated with advertising prices that are 3-4% higher. My earlier results (see Table 4) showed that markets with more newspapers tended to have greater segmentation. Taken together these results explain the phenomenon described in Table 2 that markets with more newspapers have higher advertising prices, on average. The results are consistent with the notion that advertisers value more homogenous groups of consumers.

¹⁵Demographic data at the zip level are only available from the decennial census so these values are the same for each of the four years in my data. In theory, even if annual demographic data were available (as they are at more aggregated levels of geography) the year-to-year variation would be unlikely to be enough to identify the parameters of interest.

	(1)	(2)	(3)	(4)	(5)
Number of Firms	0.014 [3.11]	0.014 [2.93]	0.015 [3.13]	0.014 [3.01]	0.016 [3.53]
Retail Establishments	-0.001 [2.22]	-0.001 [2.02]	-0.001 [2.11]	-0.001 [2.13]	-0.001 [2.71]
Fraction White	-0.058 [0.66]	-0.084 [0.96]	-0.074 [0.85]	-0.076 [0.86]	-0.02 [0.23]
Median Income	0 [0.21]	0 [0.08]	0 [0.02]	0 [0.07]	0.001 [0.68]
Pages	-0.007 [10.87]	-0.007 [11.11]	-0.007 [10.98]	-0.007 [11.06]	-0.006 [9.45]
Distance Std Deviation	-0.003 [3.8]	-0.003 [3.89]	-0.003 [3.66]	-0.003 [3.72]	-
Race Segmentation	0.223 [3.44]	-	-	-	-
Income Segmentation	-	0.14 [2.3]	-	-	-
Educ. Segmentation (<12)	-	-	0.196 [3.29]	-	-
Educ. Segmentation (College)	-	-	-	0.166 [2.83]	-
R-square (1st stage)	-	-	-	-	0.366 [6.9]
Constant	2.534 [13.53]	2.543 [13.52]	2.535 [13.53]	2.534 [13.49]	2.351 [23.06]
Observations	3206	3206	3206	3206	3206
R Square	0.261	0.255	0.26	0.258	0.273

Note: T-Statistics are in brackets

Table 6: Panel regression of advertising rates, Between Estimator

	(1)	(2)	(3)	(4)	(5)
Number of Firms	-0.068 [0.67]	-0.073 [0.71]	-0.052 [0.51]	-0.057 [0.56]	-0.971 [0.7]
Retail Establishments	0 [1.69]	0 [1.69]	0 [2]	-0.001 [2.24]	-0.001 [2.42]
Fraction White	0.466 [3.94]	0.462 [3.91]	0.435 [3.71]	0.417 [3.54]	0.256 [2.16]
Median Income	-0.007 [4.68]	-0.006 [4.44]	-0.006 [4.38]	-0.006 [4.4]	-0.006 [4.31]
Pages	-0.006 [15.66]	-0.006 [15.59]	-0.006 [15.41]	-0.006 [15.5]	-0.006 [15.04]
Distance Std Deviation	-0.003 [5.41]	-0.003 [5.45]	-0.003 [5.35]	-0.003 [5.55]	-
Race Segmentation	0.167 [3.88]	-	-	-	-
Income Segmentation	-	0.159 [4.13]	-	-	-
Educ. Segmentation (<12)	-	-	0.261 [7.16]	-	-
Educ. Segmentation (College)	-	-	-	0.248 [6.86]	-
R-square (1st stage)	-	-	-	-	0.387 [11.04]
Constant	2.336 [14.76]	2.322 [14.66]	2.369 [15.11]	2.354 [15]	2.244 [14.57]
Observations	2185	2185	2185	2185	2185
R Square	0.653	0.653	0.659	0.659	0.666

Note: T-Statistics are in brackets

Table 7: Regression of advertising rates, market fixed effects

7 Conclusion

This paper has examined how advertising prices are determined in newspaper markets. Although the application can be extended to other media markets too, newspaper markets probably provide the ideal data to analyze how the degree of subscriber targeting affects advertising rates and the value of placing advertisements. The paper examines whether newspapers with a more homogenous subscriber base charge higher advertising prices, all else equal.

I first describe a model which takes into account optimal behavior by newspaper publishers and potential advertisers and derive a relationship between equilibrium advertising prices and characteristics of the newspaper's reading base. I then use detailed data on circulation along with information on prices and other newspaper characteristics to estimate the effect of demographics and geographic dispersion on prices. A striking result of the estimation is how homogeneity among readers—measured according to race, income and education—is associated with higher advertising rates. Other estimates of the model are also according to expectations: the feature that more geographically dispersed newspapers offer less value to advertisers and that a higher number of pages also decreases value by decreasing the probability that advertisements will be seen by readers.

I also examine whether advertising prices are affected by the number of other newspapers in the market. To the extent that newspapers have distinct and non-overlapping readership, advertising prices at any one newspaper should not be affected by prices set by other publishers. This is indeed borne out by the results, once market fixed effects are included. This suggests that it may be appropriate to view newspaper publishers as monopolists in advertising markets, or at least possessing considerable market power, even though they may compete fiercely in the circulation market.

The model of optimal behavior by publishers is incomplete in the sense that it does not fully address the double sided nature of this market. With two sets of consumers and two sets of prices, the profit maximizing problem for publishers is complex; indeed too complex to address along with the issues of market segmentation that I have addressed here. This is the reason that I examined the publisher's pricing decision more closely in Chandra (2006a), using a subset of my data, and using information on the volume of advertising that each newspaper carries.

The estimation results imply that newspapers whose readers share similar characteristics have higher equilibrium advertising prices. This is consistent with a higher valuation of such readers by advertisers. All else equal, there will be a greater demand by advertisers to advertise to two readers of similar characteristics than two readers of differing characteristics. This suggests that media targeting, and the segmentation of subscribers into

well-defined groups, adds value to advertisers by allowing them to hone in on consumers who are more likely to buy their products. Multiple media with smaller, sharply differentiated audiences, therefore, are likely to provide greater value to advertisers than large media with heterogenous subscribers.

From the point of view of consumers too, it seems that better targeting of advertising is utility enhancing. The results of Chandra (2006a) seem to confirm that consumers derive higher utility, or lower disutility, from the advertising of products that are more relevant to them. It would be hasty to conclude, however, that such media segmentation is desirable from a policy perspective. In order to address that issue, the fixed costs of multiple media need to be taken into account, as well as the preferences of newspaper readers. From a social welfare standpoint, there is some evidence that consumers may actually benefit from having fewer newspapers. For example, George (2001) shows that greater concentration in the newspaper industry can actually lead to greater variety, since publishers do not duplicate certain sections. However, this needs to be weighed against the higher circulation prices that consumers would presumably end up paying as a result of lower competition. The effect of concentration on readers' welfare, therefore, appears to be ambiguous. By contrast, my results suggest a clear gain to the advertising side of this market from having more media; not simply through the avenue of lower advertising prices, but due to the greater opportunities for consumer targeting that would be implied.

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