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# TARGETED ADVERTISING: THE ROLE OF SUBSCRIBER CHARACTERISTICS IN MEDIA MARKETS*

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This paper seeks to establish the importance of targeted advertising in media markets. Using zip-code level circulation for U.S. newspapers, I show that newspapers facing more competition have lower circulation prices but higher advertising prices than similar newspapers facing little or no competition. I explain this by showing that newspapers in more competitive markets are better able to segment readers according to their location and demographics. This leads to greater homogeneity in the characteristics of subscribers and raises advertisers' willingness to pay for such readers. The results imply a substantial benefit to advertisers and media firms from targeted advertising.

## I. INTRODUCTION

IN THIS PAPER I INVESTIGATE WHETHER 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. 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, heterogeneous groups of consumers. Consider two hypothetical cities with the same population and demographic characteristics. In the first, there are two newspapers, each of which has roughly uniform sales across the various demographic groups in the city. In the second, there are also two newspapers, with similar levels of circulation as in the first city, but they reach extremely segmented groups of subscribers; for example, one has sales

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concentrated among affluent readers, while the other is read primarily by low-income readers. Under fairly reasonable assumptions on consumer and advertiser behavior, it is possible to show that average advertising prices will be higher in the second case. More generally, media that successfully segment their subscribers according to income, age, race, geographic location, or political leaning, are likely to charge higher advertising prices, *per subscriber*. In other words, media that are successful in targeting homogenous groups of consumers should 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 desired 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 heterogeneous consumers is less attractive than the opportunity to place separate 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. For example, 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; it is simply that the market price will increase in this level of homogeneity.

The rewards from reaching a select group of homogenous consumers are quite apparent. Targeted advertising is becoming 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 of examining 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 they charge a positive price for both sets of goods that they produce.[1] This is an advantage 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 doubts about the representativeness 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 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 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, as well as 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 empirical literature on media markets in a number of ways. First, its focus on advertising prices rather than subscriber benefits

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

fills an obvious gap; recent empirical research has tended to examine media markets from the point of view of readers or listeners rather than from the point of view of advertisers.[2] Second, this paper has a potential policy implication in that it makes the case that 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. I use detailed zip-code level data on circulation which provide a much clearer picture of competition than the aggregate data used in some previous work. The zip-code 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 zip-codes 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 II reviews the literature on media markets and, in particular, newspaper markets. Section III 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. It then briefly describes the estimating equation that will be taken to the data. Section IV describes the data available for estimation. Results are presented in Section V and Section VI concludes.

## II. RELATED RESEARCH

There has been substantial work on media markets, and in particular the newspaper industry.[3] 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 [2006a]. 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

[2] See, for example, George and Waldfogel [2003], Berry and Waldfogel [2001] and Berry and Waldfogel [1999].

[3] Some of the older papers include Rosse [1970], Dertouzos and Trautman [1990] and Thompson [1989]. An example of more recent work is Gentzkow [2007]. Chandra [2006b] surveys this literature.

consumers, i.e., without considering the intermediary role of media. Hernandez-Garcia [1997] 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-Gonzalez [2004] find that if firms are allowed to target distinct groups of consumers, their profits rise. Iyer *et al.* [2005] also show that targeted advertising 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.[4]

Turning to empirical work, there have been a number of studies of the effect of readers' characteristics on advertising prices, although with very little mention of the role of reader homogeneity in these markets. Thompson [1989] examines British newspapers and Depken [2004] and Koschat and Putsis [2000] examine reader characteristics in U.S. magazine markets. Using television data, Kieschnik *et al.* [2001] provide an empirical model that separates the willingness-to-pay by advertisers of two different consumer types. Also see George and Waldfogel [2003] who use a dataset very similar to mine, although they do not examine advertising prices.

Goettler [1999] performs a 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 clearly show that greater homogeneity in age and gender are associated with significantly higher advertising prices per viewer.

The product level data on subscribers used by Goettler are valuable 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;

[4] See also Wildman [2003] which theoretically examines the effect of different types of television viewers on ad prices.

Goettler, for example, does not have data on the physical location of television audiences.[5] He also does not have data on race, income or education, which I find to be useful explanatory variables in the newspaper market.

Koschat and Putsis [2002] attempt to estimate the effect of 'unbundling' in magazine advertising. That is, they use the estimated coefficients for various demographic characteristics to predict advertising prices in the counterfactual event of advertisers' being permitted to directly reach smaller groups having these characteristics. They infer an advertising premium from publishing homogenous editions.[6]

Two recent papers study the determinants of advertising pricing in television markets. Wilbur [2007] empirically examines the determinants of television advertising pricing, though without having demographic data for television viewers. Fu *et al.* [2007] also examine the role of consumer homogeneity in determining advertising prices. However, their measure relies on consumer purchasing behavior, as opposed to my measure which relies on demographics. They show that television advertising prices increase with the degree to which the program's viewers make similar choices among advertised products, among other factors.

Finally, there has been recent work examining online advertising. Goldfarb and Tucker [2007] show that the wide variation in the pricing of online search advertisements results from price discrimination by the search-engine vendor and reflects the ability of the vendor to extract surplus from advertisers who face varying market conditions. These results are consistent with the effects of targeted advertising. An interesting parallel to my application has been found in the online market for search-engine advertising. Ghose and Yang [2007] find that firms bid higher prices (on a pay-per-click basis) for longer search terms. This corresponds to firms placing a higher value, per expected consumer, on more narrow searches which is consistent with a story of targeted advertising.[7]

## III. A MODEL OF ADVERTISING PRICING IN DIFFERENTIATED MEDIA

In this section I describe a simple model that provides intuition on the effect of differentiated media in advertising markets. I also specify the estimating

[5] It 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.

[6] This study makes some rather strong assumptions, namely that characteristics of the magazines including prices, and proportional sales would be unchanged if the magazines were to sell directly to individual demographic groups. By contrast, my method directly measures the homogeneity level at existing newspapers and estimates its effect on advertising prices.

[7] Somewhat surprisingly, in my view, the authors go on to conclude that this behavior is sub-optimal, and that advertisers should in fact bid lower amounts for longer keyword searches.

equation that will be used to test for the effects of targeted advertising in newspaper markets.

### III(i). *A Hotelling Model of 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, or along other dimensions such as demographic characteristics.

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 $\theta$ 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:

$$p(\theta, x) = 1 - (\theta - x)^2$$

Therefore, the probability that the consumer buys from a firm at her very own location, conditional on seeing the firm's advertisement is 1.[8]

I assume that the expected net return to any firm from a transaction with a consumer is a positive, constant value. Media firms set the price of advertising and can display any number of advertisements, though at a positive marginal cost.

I consider two cases: in Case 1, there is a single media firm in the market, reaching the entire mass of consumers. In Case 2, there are two media in the market, with Medium 1 reaching consumers located in the interval [0,1/2] and Medium 2 reaching consumers located in the interval [1/2,1]. Note that in this model, I abstract away from fixed costs of operating, and thus the entry behavior of media firms, as well as pricing behavior and competition on the subscriber side of the market. The objective here is simply to focus on the effect on advertising prices as the market structure changes from a monopoly to a duopoly.

It is straightforward to show that, except when marginal costs are very low, advertising prices per reader are higher in the duopoly than in the monopoly.[9] Essentially, despite having competition between two firms, Case 2 offers a higher valuation to advertisers and the increase in value outweighs the competitive effect to the extent that prices per consumer are higher in this case. This is because the two media segment the market and allow advertisers to appeal to more valuable consumers. It is only in the case when costs are

[8] This functional form was chosen for its tractability. Results are similar using the function $p(\theta,x) = 1 - |\theta - x|$.

[9] The derivation of the results of this subsection are available in a supplemental file in the online version of this article.

very low that the monopoly firm can continue to extract the entire willingness-to-pay from advertisers, while the duopolists compete prices down to below the monopoly level.

This result is not driven by the assumption on the distribution of consumers. Assuming instead that consumers follow a Beta distribution on [0,1] leads to a greater mass of consumers at the center of the line, and therefore ensures that an advertiser closer to $x = 1/2$ has a much greater willingness-to-pay for advertising than in the case with uniform distribution. Even though this implies that the duopolists compete more fiercely for these advertisers, the result is essentially unchanged; except for very low levels of cost, prices per consumer are higher in duopoly than in monopoly.

It is important to note that we observe higher advertising prices per capita with two firms, even in the presence of competition. If I remove the restriction that firms can place a maximum of one advertisement, and instead allow them to purchase ads at any medium where the expected return outweighs the cost, the result is even stronger. This is because each media firm behaves as a monopolist with respect to its own circulation base. Prices are not competed down to attract the marginal advertiser, and therefore having multiple media leads to higher advertising prices due to the increase in value from being able to target consumers. The model above emphasizes that, even when media firms compete for advertisers, we can still observe higher advertising prices per consumer. 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. I now examine whether we observe this phenomenon empirically.

### III(ii). *The Model: Determining the Price Of Advertising*

It may at first seem natural to assume that advertisers view different newspapers as substitutes. However, the degree of substitutability depends on newspaper readership; in particular, the extent of overlap among rival newspapers and, therefore, the extent to which there is a business-stealing effect in print advertising markets. In the extreme case, with zero overlap of readers across newspapers, every newspaper publisher is a monopolist with respect to its circulation base.[10] At the other extreme, with complete overlap, the newspapers are perfect substitutes.

In the market for local newspapers in the U.S., a reasonable assumption is that most consumers purchase at most one local paper. This is an assumption used to motivate the discrete choice model of Chandra

[10] Even in the case with zero readership overlap, newspapers are not exactly monopolists in the larger advertising market since they still face competition from other media such as television, radio and direct mail. However, they can be considered to be monopolists within the newspaper market; that is, they can ignore advertising prices set by other newspaper publishers.

[2006a]. As discussed in that paper, the data support the notion that consumers rarely buy multiple papers at the local level. While consumers often buy a national paper in conjunction with a local paper, the product offerings are usually quite different, and potential advertisers are drawn from different pools as well.

Note that a similar assumption is made by Rysman [2002] in the market for Yellow Page advertising. He assumes that demand by advertisers is separable at various Yellow Page directories; i.e., advertisers make decisions on whether to advertise at any given directory independent of characteristics and prices at other directories. This implies that publishers ignore the prices set by rival publishers. Rysman also presents empirical evidence to support this assumption.

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, even if there is zero overlap of readers, and price competition will ensue. In the empirical section, I include controls for the number of firms in order to check for this possibility.

For a given newspaper, there is a certain value that an advertiser derives from placing an ad 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 decide to purchase the advertised product; and the expected profit that the firm makes from their purchase. 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.

Assuming, therefore, that the advertising decision is separate across different newspapers, I represent the expected profit to firm $i$ from advertising at newspaper $k$ as:

$$\pi_{ik} = f(N_k, q_k, X_k, D_{ik}) - p_k$$

Here, $N_k$ is a newspaper specific term which denotes the value of an advertisement in newspaper $k$ that is independent of the characteristics of its circulation; for example, the probability that a given advertisement is seen by the newspaper's readers. In practice, $N_k$ can be captured by the number of pages in newspaper $k$. The number of subscribers is given by $q_k$ and their characteristics are contained in $X_k$. The newspaper-advertiser specific term, $D_{ik}$, captures the idiosyncratic value that advertiser $i$ places on reaching the subscribers of newspaper $k$; for example, the physical distance between the advertising firm and the newspaper's readers. Finally, $p_k$ is the price of advertising at newspaper $k$. Note that the advertiser's profit is not dependent

on characteristics of the newspaper such as quality, editorial content or political leaning. This is because the profit is directly a function of the number of newspapers sold. Conditional on this number, the only newspaper-specific characteristics that advertisers care about are the probability that their advertisement is actually seen and the characteristics of the readers.

The profit function above, when combined with assumptions about the competitive nature of the advertising market, leads to a straightforward derivation of a reduced form relationship expressing advertising prices as a function of the number of newspaper subscribers and their characteristics. Note that such a relationship can be derived, using standard techniques, no matter whether we assume that the market is competitive, or that individual newspapers set prices ignoring the actions of other publishers. This equilibrium relationship treats consumers' characteristics as demand shifters in the advertising market. It can be written as

$$p_k = g(N_k, q_k, X_k, D_{ik})$$

I assume that, 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. This assumption abstracts away from the cost structure of advertisers.[11] Nevertheless, it is a realistic representation of newspaper advertisement 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.[12]

This assumption can be written as,

$$p_k = h(N_k, X_k, D_{ik}) * q_k$$

or,

$$R_k = h(N_k, X_k, D_{ik}) \quad (1)$$

where $R_k$ is the advertising price per reader. The equilibrium relationship, therefore, can be estimated by regressing advertising prices, normalized by circulation, on characteristics of subscribers as well as certain newspaper-specific characteristics.

## IV. DATA

The data for this paper are drawn from a number of different sources. I use zip-code circulation data from the Audit Bureau of Circulations (ABC), an

[11] This is 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.

[12] Previous authors have shown that advertising profits or prices are directly proportional to the size of the audience. See, for example, Gabszewicz *et al*. [2004].

independent, not-for-profit organization that is widely recognized as the leading auditor of periodical information in the U.S. 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 839 U.S. daily newspapers for the years 1995, 1996, 1998 and 1999. For each newspaper, I know all the zip codes in which it is present, and the number of copies sold (weekday and Sunday separately). My dataset does not consist of the entire set of U.S. newspapers; I have left out some of the largest, national newspapers such as the *New York Times* and *USA Today* because the goal of this 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 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 U.S. I have matched this information to the newspapers in the ABC database. Finally, I extracted data from the U.S. Census of 2000 that matches to each zip-code, detailed demographic data: race composition, median income, education distribution and population.[13]

Summary Statistics of the data are in Table I. For the circulation figures, each observation is a newspaper-zip-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

[13] The 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.

TABLE I
SUMMARY STATISTICS

| | Mean | StDev | Min | Max |
|---|---|---|---|---|
| *Newspaper-zip-years* (189271 obs) | | | | |
| Daily Circ. | 951 | 1803 | 1 | 39909 |
| Sunday Circ. | 1087 | 2090 | 0 | 22981 |
| *Zipcodes* (27151 obs) | | | | |
| Adult Population (1000) | 7.52 | 10.03 | 0.01 | 91.9 |
| Fraction Non-Hispanic White | 0.82 | 0.23 | 0 | 1 |
| Median Income (1000) | 41 | 16 | 3 | 200 |
| 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 |
| *Newspaper-Years* (3356 obs) | | | | |
| Year | 1997 | 1.6 | 1995 | 1999 |
| Aggregate Daily Circ. (1000) | 53.6 | 97.0 | 2.1 | 1078.1 |
| 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 (1000) | 40.9 | 9.7 | 22.5 | 95.5 |
| 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 10,000 readers | 10.44 | 4.27 | 2.14 | 39.23 |
| Retail Establishments | 109.4 | 37.1 | 9.7 | 362.2 |

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 rates as measures of quantity and price, ignoring weekend circulation and prices.[14] 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 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 II 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*),

[14] This 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.

TABLE II
NEWSPAPER PRICES BY DECILES OF COMPETITIVE INDEX

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

also takes into account the intensity of competition that newspapers face. In each zip-code, I compute the Herfindahl index, based on the daily market shares of circulation ($s$) of newspapers in the zip-code. Then, for each newspaper, I take the average Herfindahl index in all the zip-codes where it circulates, weighted by its circulation ($circ$) in each zip-code. Therefore, for newspaper $p$,

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

The first column of Table II ranks the deciles of this competitive index, where newspapers with the lowest values of $WH$, that is the newspapers facing the most intense competition, are in the first decile and so on. The second 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. Note that the direction of causality should not be inferred, however the figures support the notion that greater competition is associated with lower prices.

The third 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. The relationship is not monotonic and, as above, we cannot infer the direction of causality. Nevertheless, 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.

It is revealing that the relationship in Column 3 is virtually the opposite of the one in Column 2. The figures for circulation prices suggest that there are indeed competitive effects of rival newspapers. Presumably, this competitive effect is present in advertising markets too. However the results of the third 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.

Note that the advertising prices used here are the official price per column inch of advertising space. It is not the actual transaction price, which is usually lower, for two reasons: (a) Due to discounts for large or frequent buyers and (b) Due to quantity discounts for the size of the advertisement; for example, a full-page ad usually costs less than two half page ads and so on. Given that I am estimating the effect of homogeneity on advertising prices, rather than trying to compute some measure of welfare or surplus, it is not necessary to have transaction prices as long as the list prices are proportional to transaction prices, and are not systematically different from transaction prices for particular kinds of newspapers. To verify this point, I was able to obtain the entire menu of prices (known as the rate-card) at five large newspapers. These contain prices for various sizes of advertisements, as well as rates by day of week, and for classified advertising. I was able to confirm that the rate-card prices were indeed proportional to the price per column inch for this set of papers. I make the assumption that the discount off the quoted list prices is not systematically different for particular kinds of newspapers. In particular, I assume that newspapers reaching more homogenous readers do not have systematically larger or smaller discounts off the list price than do other papers.

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* zip-codes. These measures mask the variation *within* zip-codes 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.[15]

Therefore, any relation that I estimate between reader homogeneity and advertising prices is necessarily a *lower bound*, as the results rely entirely on across-zipcode variation, completely ignoring within-zipcode variation.

## V. RESULTS

In this section I discuss the empirical formulation that will be used in the estimation of Equation (1) and present the regression results.

### V(i). *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, heterogeneous 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 vehicles for retailers who want to reach consumers that are located close to them. However, segmentation can also 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

[15] 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.

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 self-selection by subscribers.[16] 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 per-capita 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, I define

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

where

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

is the per-capita circulation in zip-code $k$, and $x_k$ is a given demographic variable. 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.

The correlation measure of segmentation has the desirable characteristic of directly relating variation in newspaper sales to variation in demographics. Absent more disaggregated data on demographics, other measures of segmentation are generally not appropriate. For example, a natural way to measure dispersion is a standard deviation based statistic. That is, for a given demographic, calculate the standard deviation of the values across the zip-codes in which a newspaper circulates.[17] However, while this works as a measure of dispersion, it is undesirable as a measure of homogeneity in my particular application. As an example, consider two cases. In Case 1 we have 2 zip codes, where the fraction white is 0.5 in each zip code. In Case 2 we also

[16] The latter is presumably a function of the former.
[17] This should be weighted by the paper's circulation in each zip-code.

have 2 zips, where the fraction white is 0.9 and 1. Clearly, the second case represents a more homogenous population, but it will have a higher standard deviation than the first case. Note that this problem will also apply to other measures of calculating dispersion such as the relative mean difference and the Gini coefficient, both of which rely on the difference between various observations, and both of which would result in a zero value in Case 1 and a positive value in Case 2.

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 zip-codes 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. Nevertheless, 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 III, 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 zip-code's population that is Non-Hispanic White; Income – Zip-code 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 zip-code's distance from the newspaper's publishing office. Finally, the last line of Table III 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 zip-codes in which it circulates, and then taking the square root of the R-square of each regression.[18] This requires dropping some newspapers which circulate in very few zip-codes. Since a handful of newspapers

[18] Recall 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.

TABLE III
CORRELATION OF DEMOGRAPHICS WITH PER-CAPITA CIRCULATION: SELECTED PERCENTILES

| | 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 |

circulate in a very small number of zip-codes, some in as few as 3, these papers would not have enough degrees of freedom to estimate meaningfully the regression described above using 6 demographic variables. I have dropped the newspapers circulating in fewer than nine zip-codes in order to calculate values in the last line of Table III.[19]

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 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.[20]

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 principle, 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.

[19] There are 33 such newspapers, out of a total of 839.

[20] This is driven by the fact that there is simply less variation in the gender distribution across zipcodes than in the education distribution, as can be seen from Table 1.

TABLE IV
THE RELATION BETWEEN COMPETITION AND SEGMENTATION

| | 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 |

I now examine whether markets with more newspapers exhibit increased segmentation, i.e., whether newspapers in such markets have more homogenous readers. Recall that this could be one explanation for the results of Table II, 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 in Section IV and its R-square measure. The results are shown in Table IV. 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 attract entry. Regardless, the correlations are consistent with the results shown in Table II 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 IV are highly significant. The magnitudes are moderately high; however, as discussed in Section IV, these values are derived from means at the zip-code 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 that in a dispersed, wide-ranging area. To measure geographic dispersion, I calculate, for each zip-code in which a newspaper is present, its distance from the newspaper's home zip-code. This is defined as the zip-code where the newspaper's publishing office is

located.[21] I then use as a measure of dispersion of the newspaper's circulation various statistics such as the median zip-code's distance or the standard deviation of all the distances, weighted by circulation. 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 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 MSA's, 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's 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 MSA's (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. See Chandra [2006a] for details.

### V(ii). *Regression Results*

Table V contains the results of estimating equation 1. The dependent variable is the log of the daily advertising rate. The distance measure is the

[21] I also tried defining the home zip as the zip-code 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.

TABLE V
REGRESSION OF LOG ADVERTISING RATE PER 10,000 READERS

| | Excluding Segmentation | Correlation Measures of Segmentation | | | | | | $R^2$ Measure of Segmentation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | OLS | Between | Fixed effects |
| Number of Firms | 0.016 | 0.017 | 0.016 | 0.016 | 0.016 | 0.016 | 0.016 | 0.013 | 0.014 | −0.071 |
| | [6.50]** | [6.76]** | [6.63]** | [6.36]** | [6.32]** | [6.62]** | [6.59]** | [5.44]** | [3.04]** | [0.74] |
| Fraction 65+ | 0.69 | 0.709 | 0.571 | 0.586 | 0.655 | 0.576 | 0.503 | 0.456 | 0.598 | −1.122 |
| | [4.06]** | [4.19]** | [3.35]** | [3.45]** | [3.85]** | [3.40]** | [2.95]** | [2.69]** | [1.86] | [3.10]** |
| Fraction Male | 2.593 | 2.473 | 2.204 | 2.235 | 2.428 | 2.283 | 1.92 | 0.375 | 0.535 | −2.031 |
| | [5.72]** | [5.48]** | [4.83]** | [4.92]** | [5.34]** | [5.05]** | [4.21]** | [0.79] | [0.59] | [2.00]* |
| Fraction White | −0.158 | −0.139 | −0.11 | −0.137 | −0.136 | −0.108 | −0.081 | 0.016 | −0.007 | 0.559 |
| | [3.20]** | [2.83]** | [2.22]* | [2.79]** | [2.74]** | [2.19]* | [1.63] | [0.33] | [0.08] | [4.44]** |
| Median Income | 0.001 | 0 | 0 | 0.001 | 0 | 0 | 0 | −0.001 | 0 | −0.007 |
| | [0.69] | [0.60] | [0.10] | [0.73] | [0.38] | [0.14] | [0.16] | [0.90] | [0.30] | [4.45]** |
| Pages Daily (10s) | −0.076 | −0.072 | −0.072 | −0.072 | −0.075 | −0.071 | −0.068 | −0.057 | −0.061 | −0.053 |
| | [23.45]** | [22.16]** | [21.98]** | [22.27]** | [23.30]** | [21.88]** | [20.46]** | [16.66]** | [9.12]** | [13.61]** |
| Median Zip distance (10 km) | −0.004 | −0.003 | −0.003 | −0.003 | −0.003 | −0.003 | −0.003 | – | – | – |
| | [7.41]** | [6.63]** | [6.98]** | [6.90]** | [7.05]** | [6.68]** | [5.99]** | | | |
| Educ. Segmentation | – | 0.175 | – | – | – | – | 0.078 | – | – | – |
| | | [6.02]** | | | | | [2.38]* | | | |
| Race Segmentation | – | – | 0.182 | – | – | – | 0.058 | – | – | – |
| | | | [5.62]** | | | | [1.60] | | | |
| Age Segmentation (65+) | – | – | – | 0.183 | – | – | 0.126 | – | – | – |
| | | | | [6.11]** | | | [4.06]** | | | |
| Income Segmentation | – | – | – | – | 0.114 | – | 0.025 | – | – | – |
| | | | | | [3.74]** | | [0.76] | | | |
| Hispanic Segmentation | – | – | – | – | – | 0.242 | 0.167 | – | – | – |
| | | | | | | [7.34]** | [4.56]** | | | |
| Combined Segmentation | – | – | – | – | – | – | – | 0.248 | 0.258 | 0.214 |
| | | | | | | | | [9.19]** | [4.78]** | [6.19]** |
| Constant | −7.975 | −7.986 | −7.83 | −7.849 | −7.925 | −7.885 | −7.775 | −7.182 | −7.197 | −5.875 |
| | [35.38]** | [35.62]** | [34.67]** | [34.87]** | [35.17]** | [35.22]** | [34.54]** | [30.80]** | [16.24]** | [11.13]** |
| Observations | 3206 | 3206 | 3206 | 3206 | 3206 | 3206 | 3206 | 3075 | 3075 | 2102 |
| R-squared | 0.26 | 0.27 | 0.27 | 0.27 | 0.27 | 0.28 | 0.29 | 0.26 | 0.24 | 0.66 |

Note: T-statistics are in brackets.

distance, in tens of kilometers, of the median zip-code from the newspaper's publishing office zip-code. The first column simply regresses this variable on mean demographics of the zip-codes in which the newspaper circulates, the number of pages in the newspaper, and the distance of the median zip-code from the newspaper's publishing office. The next five columns provide estimates using the various correlation measures of segmentation, according to education, race, age, income and Hispanic status. 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 gender and various income and education demographic variables — 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. Other regressors in the estimation, the coefficients of which are not reported, include year fixed effects and the average number of retail establishments in the newspaper's circulation area.

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 are associated with an 8% reduction in advertising prices. As discussed above, estimation does not require the use of quantity data on advertising, since the reduced form specification eliminates this variable. However, one would expect that the number of pages in the newspaper is correlated with the quantity of advertising. To that extent, the coefficient on the number of pages is likely to be biased, although the direction of the bias is uncertain. Nevertheless, the negative and strongly significant coefficient on the number of pages is likely to reflect, at least partly, the crowding out effect of advertising; that is, that advertisers have a lower willingness-to-pay to advertise in a larger newspaper, keeping all else equal.

Column 7 uses all the individual correlation measures together. This does not change the results for the distance measure and the number of pages. However, it becomes clear that age and Hispanic status are associated with higher advertising prices than the other segmentation measures. Some of the other coefficients decrease, but this is due to the fact that the various segmentation measures are correlated; for example, populations that are homogenous along demographics such as race, age and education are more likely to be homogenous according to income. In other words, while segmentation by income increases advertising prices, it does not do so once we control for segmentation by race and by age.

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 zip-code on all the demographic and geographic variables available, and use the fit of that regression as the measure of reader homogeneity. The regression is:

$$m_{ik} = \beta_0 + \beta_1 FractionWhite_k + \beta_2 Income_k + \beta_3 Education_k + \beta_4 Dist_{ik}$$

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

Column 8 of Table V includes this R-square measure, labeled as Combined Segmentation, and omits the individual correlations. Clearly, the coefficient on this measure is positive and highly significant. Note that the coefficient 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. 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 2.7%. To put these results into perspective, consider two newspapers; one where demographics perfectly predict circulation, and the other where demographics are completely uncorrelated with circulation. This translates into first stage R-squares of 1 and 0 respectively. The results suggest, keeping all other characteristics identical, that the first newspaper will be able to charge almost 30% more per subscriber. And, as pointed out above, these results are merely a lower bound on the actual effect of subscriber homogeneity on advertising prices.

Columns 9 and 10 provide some alternative specifications using the Combined Segmentation measure. Column 9 uses the between estimator, which averages variation across time and relies solely on variation between firms, and can be used to examine the same relationship as above. To see the difference between the pooled case with time fixed effects and the between estimator, note that the former treats observations from the same newspaper over time as being independent, and simply allows for an average year effect to be estimated. By contrast, the latter ignores all the variation across time for a given newspaper, and instead averages the dependent and independent variables over time for each unit, using only variation across units to estimate the model.

The standard errors in Column 9 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.[22] Additionally,

[22] An additional specification, which clusters standard errors by newspaper, leads to results that are very similar in magnitude and significance to those of the between estimator. These results are available in the online version of this article.

using the between estimator with individual segmentation measures leads to results that are very similar to those in columns 2 through 6.

Finally, Column 10 includes market fixed effects in the regressions which accounts for unobserved heterogeneity across markets, but are 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. Note that coefficients on some of the demographic variables are significantly different in this regression. This is due to restricting attention to newspapers in MSAs, as well as estimating MSA fixed effects.[23]

It is worth emphasizing again that these results greatly underestimate the effect of targeted advertising. As an example, consider a newspaper circulating in 20 zip-codes, with an average readership of 500 in each zip-code. With individual level data on subscribers' characteristics, this would provide 10,000 data points to estimate the effects of demographics on advertising prices. In my study, I may rely on just 20 observations. Moreover, these 20 would be averages and would therefore have lower variance, and lower predictive power, than observations on individual readers or households. Despite these limitations, the results show that targeted advertising, as measured by zip-code means, is associated with significantly higher advertising prices.

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 is associated with advertising prices that are almost 3% higher. My earlier results (see Table IV) showed that markets with more newspapers tended to have greater segmentation. Taken together, these results explain the phenomenon described in Table II, 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.

[23] All the results in this Table are robust to splitting the data according to the number of firms in the market. Separate regressions for markets with 1, 2 and 3 or more newspapers provide very similar results. See the supplemental file in the online version of this article for details, as well as for additional robustness checks.

## VI. 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.

I first document that newspapers in more competitive markets have lower advertising prices per reader. I then use detailed data on circulation along with information on prices and other newspaper characteristics to show that markets with more newspapers are better able to segment readers according to geography and demographics, thereby increasing the homogeneity of each newspaper's subscribers. Finally, I show that this homogeneity translates into higher advertising prices through greater valuation of homogenous groups by advertising firms. This increased valuation on the demand side is enough to outweigh the competitive effect on the supply side of having more newspapers in the market.

The results relating subscriber homogeneity to advertising prices are extremely conservative estimates. Due to the aggregate nature of the data, I rely completely on variation across zip-codes, entirely ignoring variation within zip-codes. To the extent that this still leads to consistently positive and strongly significant estimates, it implies that subscriber homogeneity potentially plays an extremely important role in determining advertising value.[24]

The results suggest that media targeting, and the segmentation of subscribers into well-defined groups, adds value to advertisers by allowing them to home 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 heterogeneous subscribers.

From the point of view of consumers too, it appears 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. However, the effect of concentration on readers' welfare may be ambiguous since my results also show that newspapers in concentrated markets have higher circulation prices.[25] 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

[24] There are some methods that attempt to 'recover' individual level data from means. One of the more famous applications involves using election data of voting behavior across precincts to estimate voting patterns of demographic groups within precincts; the so-called Ecological Inference problem (see King [1997]). These methods usually involve either imprecise estimates (for example due to very large confidence intervals) or restrictive assumptions.

[25] From a social welfare standpoint, there is some evidence that consumers may actually benefit from having fewer newspapers. For example, George [2007] shows that greater concentration in the newspaper industry can actually lead to greater variety, since publishers do not duplicate certain sections.

lower advertising prices, but due to the greater opportunities for consumer targeting that result.

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