

Discussion Paper No. 10-063

## **Targeted Advertising in Magazine Markets**

Ambarish Chandra and Ulrich Kaiser

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## Executive summary

This paper examines the scope and value of targeted advertising in the German magazine industry. We use data on reader characteristics at individual media, in contrast to previous work that has needed to infer this information from aggregate data. Our results show a strong relationship between subscriber characteristics and advertising prices. Advertisers clearly value more homogenous groups of readers, measured according to income, gender and age. Our results explain recent trends of declining advertising expenditures in print media, in favor of increasing online advertising.

We distinguish between the effects of the mean and the variance of readers' characteristics on advertising prices. For example, female readers may, on average, be more valuable to advertisers than male readers, but a subscriber base that is 100% male may command higher advertising rates than one that is read equally by men and women. This gives rise to the possibility of non-monotonic relationships between readers' characteristics and advertising value. We measure the importance of targeted advertising by determining whether demographically homogenous readers are more valuable to advertisers than diverse audiences.

While this paper is related to many existing studies, there has been little research examining the specific question that we do. The existing research on targeted advertising has been mostly theoretical. Moreover, most prior studies have assumed that firms can directly target consumers, and do not incorporate the role or importance of the media in this process. We believe that this is an important omission as, in reality, the vast majority of advertising is placed through media, rather than delivered directly to consumers.

## Das Wichtigste in Kürze

Diese Arbeit untersucht die Bandbreite und den Wert von zielgerichtetem Werben auf dem deutschen Zeitschriftenmarkt. Wir verwenden Daten zu Lesercharakteristiken auf der Ebene einzelner Medien, im Gegensatz zu bestehenden Studien, die diese Angaben aus aggregierten Information ziehen. Unsere Ergebnisse zeigen eine starke Beziehung zwischen Lesercharakteristika und Anzeigenpreisen. Anzeigenkunden präferieren homogenere Lesergruppen in Bezug auf Einkommen, Geschlecht und Alter. Unsere Ergebnisse erklären den aktuellen Trend abnehmender Anzeigenaufkommen in Printmedien zu Gunsten zunehmender Online-Werbung.

Wir unterscheiden zwischen den Effekten des Mittelwertes und der Varianz von Lesereigenschaften auf den Anzeigenpreis. Zum Beispiel könnten weibliche Leser im Durchschnitt wertvoller für Anzeigenkunden sein als männliche Leser – aber eine Leserschaft, die vollständig aus Männern besteht, könnte höhere Anzeigenpreise erzielen als wenn die Leserschaft zu gleichen Teilen aus Frauen und Männern bestünde. Das gibt die Möglichkeit nichtmonotoner Beziehungen zwischen Lesereigenschaften und deren Wert für die Anzeigenkunden.

Wir messen die Wichtigkeit von zielgerichteter Werbung dadurch, dass wir analysieren, ob eine homogene Leserschaft höhere Anzeigenpreise erzielt als eine heterogene Leserschaft.

Während es zahlreiche mit dieser Arbeit verwandte Studien gibt, findet sich zu den speziellen Fragestellungen dieser Analyse wenig wissenschaftliche Vorarbeit. Bestehende Arbeiten sind vorwiegend theoretischer Natur. Zudem haben bestehende Studien angenommen, dass Unternehmen ihre Konsumenten direkt erreichen können, ohne die Rolle von Medien in diesem Prozess zu berücksichtigen. Wir glauben, dass dies eine wichtige Unterlassung ist, denn in der Realität werden Produkte über Medien beworben und nicht direkt beim Kunden.

# Targeted Advertising in Magazine Markets\*

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September 13, 2010

## Abstract

We examine the scope and value of targeted advertising in the magazine industry. We use data on reader characteristics at individual media, in contrast to previous work that has needed to infer this information from aggregate data. Our results show a strong relationship between subscriber characteristics and advertising prices. Advertisers clearly value more homogenous groups of readers, measured according to income, gender and age. Our results explain recent trends of declining advertising expenditures in print media, in favor of increasing online advertising.

**Keywords:** targeted advertising, reader homogeneity, quantile regression, magazines, advertising rates

**JEL-classification:** C21, C23, L11, M31

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\*We thank Jürgen Storp of MindShare, a global media and marketing services company, for very insightful comments.

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“Will the Internet Kill Magazines? Did Instant Coffee Kill Coffee?”

[Magazine Industry Advertising Campaign, 2010]

## 1 Introduction

The media industry is currently in a state of upheaval. On the one hand, traditional media firms, especially newspapers, are facing challenges from declining readership and an associated loss of advertising revenue. At the same time newer media entities — particularly those that are online — are generating excitement through their ability to attract large numbers of users. These events are, of course, related. Recent newspaper closings and layoffs in the United States, for example, have occurred as users migrate towards free and up-to-the-minute content provided by electronic media.<sup>1</sup>

Advertisers have followed these users, and are taking advantage of knowing precise information about their target audience. This reflects the phenomenon of targeted advertising, whereby advertisers choose which consumers to reach based on their demographics, location, or purchasing profile. However, this phenomenon is not new, nor is it restricted to electronic media. Data companies have compiled information on consumers for decades. For example,

[The data company] Acxiom estimates it has 1,500 pieces of data on every American, based on information from warranty cards, bridal and birth registries, magazine subscriptions, public records and even dog registrations with the American Kennel Club.<sup>2</sup>

These companies compile information on potential consumers for their clients; usually media entities or large firms that engage in direct mailing. Targeted advertising creates value for firms by reducing waste and inefficiencies in advertising. In 2006, the worldwide advertising industry earned \$428 Billion in revenues. According to one estimate, around

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<sup>1</sup>“Newspaper Closings Raise Fears About Industry,” *USA Today*, March 19, 2009.

<sup>2</sup>“Ads Follow Web Users, and Get More Personal,” *New York Times*, July 30, 2009.

\$220 Billion, or just over half, is “spent on messages that reach the wrong audience or none at all.”<sup>3</sup>

In this paper we investigate the importance of subscriber characteristics in advertising markets using externally audited data on the German magazine market, one of the largest magazine markets in the world.<sup>4</sup> We determine the relationship between advertising prices in the magazine industry, and characteristics of readers. We distinguish between the effects of the mean and the variance of readers’ characteristics on advertising prices. For example, female readers may, on average, be more valuable to advertisers than male readers, but a subscriber base that is 100% male may command higher advertising rates than one that is read equally by men and women. This gives rise to the possibility of non-monotonic relationships between readers’ characteristics and advertising value. We measure the importance of targeted advertising by determining whether demographically homogenous readers are more valuable to advertisers than diverse audiences.

An interesting feature of the magazine industry is that it has not been affected as severely by the advent of the Internet as has the newspaper industry. Magazine readership in the United States has grown by 4.3% in the past five years, while newspaper circulation has declined by more than ten percent over the same period.<sup>5</sup> In fact, five major magazine chains in the US recently launched an aggressive campaign called “Magazines, The Power of Print”. As of 2010, the campaign had taken out ads in most major magazines arguing that magazines are flourishing as a medium, despite the growth of the Internet; the ads also point out that during the 12-year life of Google, magazine readership has increased by 11%.

The German magazine industry — the market we investigate in this study — is not as healthy as the US market. Over the last five years total circulation has declined by 8.7% (VDZ, 2010). Despite that decline, there is still net entry into the market with

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<sup>3</sup>“The Ultimate Marketing Machine, *The Economist*,” July 8th, 2006.

<sup>4</sup>The German consumer magazine market consists of about 2,200 titles with an average quarterly circulation of 173 million copies in 2008 (Magforum 2009). This compares to a total of 3,187 titles in the US, 2,794 in the UK and 2,449 in Japan (Magforum 2009). Among the EU25 countries, the German market is the second largest in terms of the number of consumer magazines (behind Great Britain) and in terms of advertising revenues (behind France). Source: European Commission, 2005.

<sup>5</sup>Sources: MediaMark Research and the Newspaper Association of America.

an increasing number of audience-targeted magazines. The total number of titles in Germany went up by 3.2% over the same time period (VDZ 2010). German newspapers, however, encountered an even stronger decline with a decrease in circulation of 10.2% and a decrease in the number of newspapers of 7.4% (KEK-Online, 2009).

While this paper is related to many existing studies, there has been little research examining the specific question that we do. The existing research on targeted advertising has been mostly theoretical.<sup>6</sup> Moreover, most prior studies have assumed that firms can directly target consumers, and do not incorporate the role or importance of the media in this process.<sup>7</sup> We believe that this is an important omission as, in reality, the vast majority of advertising is placed through media, rather than delivered directly to consumers.

A number of empirical studies examine subscriber characteristics in media markets, including the magazine industry, but without specifically analyzing targeted advertising.<sup>8</sup> In addition, a number of prior papers have examined market structure and pricing in magazine markets.<sup>9</sup> Of the few papers that examine targeted advertising in an empirical setting, only two are directly relevant to our paper.<sup>10</sup> Chandra (2009) examines reader characteristics in newspaper markets. He establishes the importance of targeted advertising; however, he needs to infer readers' demographics by making assumptions on the relationship between media sales and the characteristics of readers. For this reason, the estimated relationships are necessarily conservative, since only aggregate data are available.

The paper closest to ours is Koschat and Putsis (2002), who make an important contribution to the literature by analyzing advertisers' willingness to pay for reader char-

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<sup>6</sup>See Anand and Shachar (2009), Dukes (2004), Esteban et al. (2001), Grossman and Shapiro (1984), Hernandez-Garcia (1997), Galeotti and Moraga-Gonzalez (2004), Gal-Or et al. (2006) and Iyer et al. (2005).

<sup>7</sup>See, in addition to the studies listed above, Chen et al (2001) and Chen and Iyer (2002). Exceptions are Gal-Or and Dukes (2003) and Gal-Or and Gal-Or (2005). More recent theoretical work has explicitly incorporated the role of the media; both Athey and Gans (2010) and Bergemann and Bonatti (2010) suggest that an increased ability to target consumers may actually decrease advertising prices.

<sup>8</sup>See Depken (2004), Kieschnik et al. (2001), Koschat and Putsis (2000, 2002) and Thompson (1989). Goettler (1999) shows that homogeneity according to gender may be desirable for television advertisers.

<sup>9</sup>See Milne (1994), Depken and Wilson (2004), Kaiser and Song (2006) and Kaiser and Wright (2006).

<sup>10</sup>See Goldfarb and Tucker (2010) for an examination of the merits of targeting versus obtrusiveness in online settings.

acteristics. They use data on US magazines and conduct a counterfactual analysis to determine the advertising rates that magazines could charge, in the event they could cater precisely to the most valuable audiences. They refer to this strategy as “pure components” pricing. The opposite approach is termed “pure bundling”, where magazines cater to both the most valuable readers as well as other readers; a strategy adopted by most magazines. The main finding is that magazines would be more profitable under pure components pricing. However, an important and somewhat strong assumption underlying their paper is that observed magazine characteristics, such as prices and sales, would not change if magazines actually switched to pure components pricing. This is in contrast to our paper where we directly measure reader homogeneity and its effect on advertising rates, without making assumptions on counterfactual events.

Our paper makes a number of contributions to the literature. First, we use considerably better data than previous work on targeted advertising. In particular, we have data on the characteristics of readers at individual publications, and therefore do not need to infer these characteristics as has been done in previous work (for example, Chandra, 2009).<sup>11</sup> In fact, we have the same data at our disposal as advertisers do, and therefore we can recover their valuation of subscriber types by examining equilibrium advertising prices at various magazines. Our identification strategy is “clean” and does not make inferences from aggregate data.

Second, we study the importance of targeted advertising in the magazine industry, in contrast to previous work examining newspapers and national television. Magazines provide a much greater scope to segment readers according to demographics than do newspaper markets, since the latter tend to segment readers largely by geography, but relatively little by demographics. On the other hand magazines tend to have little or no geographic appeal, catering instead to particular demographic groups according to their content and focus. Therefore, advertisers that care about reaching particular groups of readers, as measured by their demographics, should naturally gravitate towards maga-

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<sup>11</sup>We emphasize that it is quite hard to get data on subscriber characteristics by individual media. Most cross-sectional studies of the media, not just studies of advertising, rely on aggregate market-level data. For examples, see Berry and Waldfogel (1999a, 1999b, 2001), Rysman (2004), George and Waldfogel (2003, 2006) and Gentzkow and Shapiro (2010).

zines rather than newspapers.

Finally, we study the differential effect that reader characteristics have on magazines in different advertising rate segments. One might argue, for example, that magazines charging higher advertising rates have a stronger taste for reader homogeneity. We measure differences across magazines by running quantile regressions; these allow us to draw inferences about the relationship between readers' characteristics at various points in the distribution of advertising rates.

Our results imply that subscriber characteristics play an important role in advertising markets. Advertisers clearly value particular demographics, such as higher income, and are willing to pay considerable premiums to reach subscribers who have these characteristics. Further, advertisers strongly value homogeneity among readers, as measured by income, gender and age. Our results are robust to different specifications, and hold across the entire distribution of magazine advertising prices.

Our findings suggest a greater valuation of targeted advertising than has been found in previous work. This indicates a significant capacity for targeted advertising to increase the value that media platforms can create for advertising. In particular, it explains why advertisers appear to be embracing online platforms at the expense of traditional media, due to the vast possibilities for targeted advertising using online data, and because of the increasing segmentation of users into narrower groups on the Internet.

## 2 Data

We use data on the German magazine industry, obtained from IVW, which is the German equivalent to the Audit Bureau of Circulation in North America.<sup>12</sup> IVW ascertains, monitors and publishes information on magazine circulation and total readership. Our core data set consists of information on the total number of copies sold, subscriptions, kiosk sales, advertising pages, market reach (the number of people who read — but do

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<sup>12</sup>The original data source is “Information Association for the Determination of the Spread of Advertising Media” (“Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V.”, IVW). It has been updated quarterly since 1972 and is continuously recorded. The core data are publicly available and downloadable from <http://www.medialine.de/deutsch/wissen/zeitschriftendatenbank.html>

not necessarily buy — the magazine) content pages, advertising rates and copy prices. Both advertising rates and the number of advertising pages in a magazine issue are differentiated by black and white, two-color, and four-color advertisements.

We supplement our core data with information on readership characteristics that was made available to us by “Arbeitsgemeinschaft Media-Analyse” (AG.MA), an association of the German advertising industry for the research of mass communication. These data span the period 1998 to 2010 and contain information on each magazine’s reader composition with respect to gender, age and household income. We stress that this information is available by individual magazine, which allows for a direct examination of readers’ characteristics, in contrast to previous research.

The AG.MA data are not available for, depending on the period, between 7.1 percent and 39.4 percent of the magazines in our core data set. Magazines need to pay AG.MA in order to have their readership characteristics recorded. Magazines that are tracked by AG.MA contain on average 20 advertising pages more than those not covered by AG.MA, a difference that is statistically significant. In terms of advertising pages, the AG.MA data cover between 64.6 and 72.3 of all advertising pages; in terms of copy sales they cover between 72.9 and 78.3 percent.

Table 1 contains information on magazine characteristics such as sales, the number of pages, and advertising and copy prices for the years 1998-2010. The data are provided quarterly; we use information on the periodicity of each magazine to convert the quarterly data on market reach and the number of pages to per-issue data.

As Table 1 shows, the average magazine had sales of almost half a million in each quarter during the time period that we study; the average sales per issue were approximately 76,000. Of these, around 59% were at retail outlets such as news-stands and kiosks, 24% were subscription based and the remainder, referred to as “Freistücke”, were sold below the market cover price.<sup>13</sup> Over 25% of the pages in the average magazine are devoted to advertising, of which 88% are four-color ads, with the rest being two-color, black and white, or supplemental advertisements. The table also shows data on total

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<sup>13</sup>Freistücke are mostly distributed in airports, in order to increase sales volumes. Publishers do so in order to maintain their volumes in times of decreasing news-stand and subscription sales.

	Mean	SD	Min	5%	95%	Max
Total Sales per Quarter (1000)	421	(447)	13	94	1436	2869
Fraction Kiosksales	0.59	(0.27)	0	0.12	0.98	1
Fraction Subscriptions	0.24	(0.20)	0	0.01	0.63	1
Total Reach (1000)	1468	(1469)	130	320	5080	8010
Total Pages (Quarter)	810	(541)	104	230	1768	4740
Ad Pages (Quarter)	215	(232)	4	37	636	2336
Fraction of Ad pages:						
Black/White	0.09	(0.14)	0	0	0.41	0.98
Two color	0.03	(0.05)	0	0	0.12	0.48
Four color	0.88	(0.16)	0.02	0.5	1	1
Black/White Ad price (1000 €)	14.7	(9.4)	2	3.4	33.8	54
Color Ad price (1000 €)	17.7	(11.1)	2.2	4.4	42.8	54.5

Each observation is a magazine-quarter-year. N=6149

Table 1: Summary Statistics on Magazine Circulation

market reach for each magazine; this is the number of readers that are exposed to each issue and is, on average, over 3.

Table 2 contains summary data on reader characteristics. On average, 40% of readers are men, although the extreme values show considerable divergence, with some magazines being read almost exclusively by men or by women. Most readers are “prime age readers” as advertisers call people aged 30–49 years. They constitute almost 40% of all readers. The smallest age group are individuals younger than 20; they constitute 10% of all readers on average. Over a third of all readers enjoy a household income of over 2,500 Euros across magazines which is well above the average household income in Germany of 1,363 Euros in 2002 (BDP, 2004).

Table 2 also provides data on constructed HHI variables which we use to measure homogeneity of magazine readers. Gender appears to have the highest concentration on average, but concentration by gender also varies the most of all three demographic variables. More details on the construction of these measures are provided in the next section.

Table 3 contains information on the periodicity of magazines, which we used to convert quarterly data on magazine characteristics to per-issue values. The majority of magazines are published either weekly or monthly.

	Mean	SD	Min	5%	95%	Max
Male	0.4	(0.27)	0.02	0.07	0.87	0.97
Age:						
14-19	0.1	(0.15)	0	0.01	0.49	0.78
20-29	0.15	(0.09)	0	0.04	0.34	0.52
30-49	0.38	(0.11)	0.1	0.19	0.54	0.71
50-59	0.14	(0.06)	0	0.03	0.22	0.31
60+	0.22	(0.16)	0	0.02	0.53	0.72
Household Income (€ per month):						
2000 or less	0.45	(0.12)	0.13	0.27	0.67	0.8
2000-2500	0.21	(0.03)	0.09	0.15	0.26	0.34
2500 or more	0.35	(0.12)	0.06	0.16	0.54	0.78
Constructed HHIs:						
Gender	0.67	(0.13)	0.5	0.5	0.88	0.96
Age	0.46	(0.09)	0.3	0.33	0.62	0.75
Income	0.61	(0.03)	0.54	0.56	0.66	0.8

Each observation is a magazine-quarter-year. N=6149

Table 2: Summary Statistics on Demographic Data

Periodicity	Frequency	Percent
Monthly	3,153	51.3
Every two weeks	811	13.2
Weekly	2,173	35.3
Other	12	0.2

Table 3: Distribution of Magazine Periodicity

### 3 Empirical Specification

Our goal is to estimate the relationship between the characteristics of magazine readers and the value provided to advertisers. The latter is represented by the equilibrium advertising price at each magazine.<sup>14</sup> Instead of directly modeling the advertising price, we develop an empirical model of the advertising price *per reader*. A larger market reach will naturally increase advertising prices; our goal here is to measure how the value of the average reader depends on the characteristics of the subscriber base. Advertising prices in media industries are commonly quoted as the rate per thousand readers (ad price relative to market reach), which implies that the total value from advertising is proportional to the number of readers.<sup>15</sup>

Our regression specification takes the following form:

$$R_k = f(\mathbf{N}_k, \mathbf{X}_k) \quad (1)$$

where  $R_k$  is the advertising price per reader at magazine  $k$ ,  $\mathbf{N}_k$  is a vector representing magazine characteristics that affect the value of an advertisement in magazine  $k$ , and  $\mathbf{X}_k$  is a vector representing the characteristics of the magazine's readers.

The terms that enter  $\mathbf{N}$  consist of magazine characteristics that are independent of the number of copies sold. It is important to note that magazine characteristics such as content, quality, copy price etc., will not enter this term, as we have already conditioned on market reach by using it to normalize advertising prices as the dependent variable.<sup>16</sup> We use two characteristics to capture magazine-specific value to advertisers over and above the number of copies sold. First, we include controls for the fraction of sales that

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<sup>14</sup>Of course, the equilibrium price is only one measure of advertisers' willingness-to-pay. Our assumption is that magazines that provide greater value to advertisers will have higher advertising prices. This is reasonable given that the magazine advertising industry is by no means perfectly competitive; each magazine provides a niche audience to potential advertisers. See Chandra (2009) for a similar argument in the newspaper industry.

<sup>15</sup>Previous research has shown that advertising profits or prices are directly proportional to the size of the audience. See, for example, Gabszewicz et al (2004). Empirical studies commonly model advertising prices per subscriber; see Rysman (2004).

<sup>16</sup>We experimented with including category effects; for example, the share of content pages devoted to cosmetics, motor vehicles, nursing etc. These variables do not have statistically or economically significant effects on advertising rates, a finding that is consistent with the results of Koschat and Putsis (2002).

are at newsstands or other retail locations, versus subscription-based sales, as advertisers may value readers of the two types differently.<sup>17</sup>

Second, we measure the probability that a given advertisement is seen by the magazine’s readers, which should be an important determinant of advertising value. We do this by including the number of pages in magazine  $k$ . Keeping everything else equal — in particular market reach — advertisers should prefer placing their ads in smaller magazines where there is a lower likelihood that a given page is overlooked by readers.<sup>18</sup>

As a control variable, we include a measure of competition, namely the number of other magazines in the same category, using categories defined by the IVW. We expect magazines in the same category to have similar content and focus and, as a result, to be likely to have similar audience characteristics. Therefore, *ceteris paribus*, magazines with more rivals are likely to have lower advertising prices than specialized magazines with few rivals in the same category. However, including this competition variable, and the number of pages on the right hand side, also introduces identification problems. We return to this issue in Section 4.

$\mathbf{X}$  includes demographic characteristics in levels, as well as measures of reader homogeneity. Our interest is not just in the mean effects of reader homogeneity on ad rates but also in the differential effects of reader homogeneity on magazines charging high advertising prices versus those charging low prices. In order to explore the possibility of different effects across various percentiles of the ad rate distribution, we employ quantile regression methods. In particular, we estimate quantile regressions at the 10th, 25th, 50th, 75th and 90th percentiles of the advertising price distribution.

Both our linear regressions and our quantile regressions account for unobserved magazine-specific heterogeneity that does not change over time. While such fixed effects estimations are standard for linear models, we follow an approach recently suggested by Arulampalam

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<sup>17</sup>Oster and Scott Morton (2005) find in their analysis of US magazine data that subscription prices of investment magazines are higher than those of leisure magazines, all else being equal. They explain this finding with the existence of consumers with a “present bias” which drives consumers to purchase magazines with immediate leisure benefits rather than magazines with long-term investment benefits. The “current self” (who prefers leisure magazines) therefore has incentives to subsidize the “future self” (who prefers investment magazines) via subscriptions. This implies that subscribers and news-stand purchasers are indeed consumers with different characteristics and hence different value to advertisers.

<sup>18</sup>This is similar to the framework used by Rysman (2004).

et al. (2007) for the quantile regressions. The idea behind this estimator is to first run a standard linear fixed effects regression, back out the time-invariant error component and insert the fixed effect as an additional regressor into the quantile regressions. Alternatives to the Arulampalam et al. (2007) estimator are computationally very burdensome and often inapplicable on real data as reviewed by Holst Bache et al (2008).<sup>19</sup>

However, the insertion of estimated fixed-effects introduces a source of error in our second-stage quantile regressions due to the generated regressors problem. Additionally, standard errors may be under-estimated if heteroskedasticity is present in a quantile regression framework. To address these issues we block-bootstrap the standard errors associated with our quantile regression results using 1,000 replications.

### 3.1 Variable definitions

Our dependent variable is the advertising rate per 1,000 readers.<sup>20</sup> The advertising rate is calculated as the weighted average of the black and white, two-color and four-color advertising rates. The weights are generated from the share of the respective advertisements in the total number of advertisements for each magazine and time period.<sup>21</sup> The distribution of advertising rates is heavily skewed so we employ its natural logarithm as our dependent variable.

Advertising rates almost never deviated from list prices during the period we consider, according to industry participants. This is in accordance with Koschat and Putsis (2002) who find a correlation between transaction prices and list prices of 0.975. The German magazine market is an “up-front” market where advertising rates are published and fixed in advance every Fall for the upcoming year. This up-front price disclosure is also a feature of large US media companies. For example, CBS, ABC, NBC and Fox set advertising

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<sup>19</sup>In addition, these alternative methods also make the critical assumption — as does the Arulampalam et al estimator, and therefore our own approach — that the fixed effects are constant across quantiles.

<sup>20</sup>We also estimated regressions using the total number of copies sold, rather than market reach. The two measures are, of course, highly correlated and the results do not differ much.

<sup>21</sup>Koschat and Putsis (2002) use the price for a full color advertisement instead of weighted prices. We use weighted advertising rates because the average share of full color ads across time and magazines is 88 percent in our data, and lower in the earlier years. The correlation coefficient between our weighted prices and the prices for full color ads is, however, 0.99, and so the results are similar if we use the price of color ads alone.

rates in the Spring for advertisements appearing in the Fall (Dukes and Gal-Or, 2003; Goettler, 1999). There is anecdotal evidence for the Italian newspaper market where price lists are also published long before the newspapers actually appear. We take this specific feature of the German magazine market into account by leading our dependent variable by one year.<sup>22</sup> Contracts between advertisers and publishers specify advertising rates and a minimum guaranteed readership. If magazines fail to meet the minimum guaranteed readership, they provide make-goods in the form of free advertisements, a feature also shared by the US network TV market.

Our key explanatory variables are measures of reader homogeneity, though we also include mean readership characteristics at each magazine in our specifications. Measuring the homogeneity of readers is not straightforward, as we have categorical data on reader demographics. We consider two methods of measuring reader homogeneity. The idea behind both is to measure the *dispersion* of readers' characteristics, rather than just their mean values.

The first measure is a Herfindahl–Hirschman index (HHI) for readership characteristics. This is the sum, across categories, of squared values of each demographic variable. HHI values closer to 1 indicate greater homogeneity, while values closer to zero indicate greater diversity of characteristics. However, notice that age, for example, has more categories than income (see Table 2). Simply calculating the HHI based on our original data may artificially reduce homogeneity measures for variables having more categories. In order to deal with this, we collapse multi-category demographics such as age and income to three categories, and calculate the HHI values accordingly. Table 2 shows summary statistics on these constructed HHIs.

Our second measure is simply the square of the relevant demographic variable. With two categories, this is straightforward; for example, gender is measured by the fraction of male readers, and we include this fraction and its square as explanatory variables. For the multi-category variables we collapse the data into two categories and then calculate

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<sup>22</sup>We could have alternatively lagged the explanatory variables, which leads to identical results. Koschat and Putsis (2002) lag the explanatory variables by only half a year, partly because their data cover a shorter time period. As a side note, all our results hold, and in fact are strengthened, if we use contemporaneous data instead of leads.

the square of each measure.

Note that the signs on the estimated homogeneity measures — either the squared term or the HHI for each demographic characteristic — is expected to be the same in both regressions since both are measures of the second moment of the corresponding variable.

## 4 Results

We now present the results from estimating Equation (1). In Table 4 we present results using polynomials of demographic variables, and in Table 5 we present the results using the HHI measures of homogeneity.

### 4.1 Results for reader homogeneity

The results of Table 4 strongly support the notion that targeted advertising is important in the magazine industry. For each of our three demographic variables, the estimated coefficient is negative for the linear term but positive for the squared term. This implies a U-shaped relationship between the relevant demographic and advertising prices per reader and hence maximum ad rates reached for reader shares of 0 or 1 (perfect homogeneity). This main result holds for the fixed effects regression as well as for each of the quantile regressions.

Our fixed effects result for gender suggests that advertising is most valuable if the readership is dominated by either gender. *Ceteris paribus*, advertising prices are minimized when the fraction of male readers is around 41%.<sup>23</sup> Additionally, male readers are, on average, more valuable from the perspective of advertisers than are female readers. These results are highly significant, with p-values less than 0.01, and hold with the same significance across every quantile. This indicates that our results are a robust feature of magazines across the entire distribution of advertising rates, rather than simply being driven by a small subset of observations.

These results are repeated for the other demographics. We point out, however, that

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<sup>23</sup>The minimum of the advertising price distribution is achieved when the fraction male is  $0.583/2*0.709$ .

	Fixed-Effects	Quantile Regressions				
		10%	25%	50%	75%	90%
Fraction Male	-0.583*** (0.154)	-0.626*** (0.060)	-0.672*** (0.041)	-0.661*** (0.041)	-0.613*** (0.052)	-0.423*** (0.062)
Frac. Male Square	0.709*** (0.157)	0.695*** (0.066)	0.742*** (0.043)	0.767*** (0.040)	0.739*** (0.051)	0.575*** (0.062)
Fraction Age 14-49	-0.929*** (0.269)	-0.906*** (0.141)	-0.872*** (0.089)	-0.830*** (0.108)	-1.259*** (0.101)	-1.184*** (0.143)
Frac. 14-49 Square	0.780*** (0.213)	0.677*** (0.099)	0.719*** (0.062)	0.738*** (0.073)	1.069*** (0.071)	1.067*** (0.111)
Income below 2000	-0.943*** (0.245)	-0.792*** (0.202)	-0.988*** (0.148)	-1.191*** (0.136)	-1.277*** (0.160)	-1.294*** (0.178)
Inc. less 2000 Square	0.916*** (0.254)	0.430* (0.228)	0.769*** (0.173)	1.183*** (0.161)	1.309*** (0.170)	1.416*** (0.195)
Share Subscriptions	0.101 (0.067)	0.042 (0.027)	0.074*** (0.015)	0.095*** (0.013)	0.138*** (0.023)	0.152*** (0.022)
Share Freistücke	-0.131*** (0.049)	-0.126*** (0.028)	-0.098*** (0.015)	-0.114*** (0.014)	-0.171*** (0.017)	-0.199*** (0.027)
No. of Mags in group	-0.002 (0.002)	-0.003*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)	-0.002*** (0.000)
Log Total Pages	-0.043** (0.018)	-0.018* (0.009)	-0.029*** (0.006)	-0.051*** (0.006)	-0.068*** (0.008)	-0.092*** (0.010)
Estimated FE	-	0.931*** (0.010)	0.963*** (0.005)	0.988*** (0.005)	1.038*** (0.008)	1.076*** (0.008)
Constant	17.22*** (0.160)	17.03*** (0.083)	17.15*** (0.059)	17.29*** (0.059)	17.59*** (0.060)	17.70*** (0.087)

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Robust SEs for Fixed-effects regression, and bootstrapped SEs for quantile regressions are presented in parentheses. All regressions include year, quarter and magazine fixed-effects and use 6149 observations on 182 magazines.

Table 4: Regression of Log Advertising price per 1000 readers: Polynomial Specification

the point estimates for age and income need to be interpreted with caution, since they are a function of the data categories, and our choice of cutoff points.<sup>24</sup> In particular, we refrain from highlighting any value as representing the minimum of advertising prices, for these two demographic variables.

Our results nevertheless indicate that reader concentration in age is a more desirable outcome for advertisers than an equal share of readers in each age group. This result generally holds across the ad rate distribution but the age–ad rate profile becomes steeper for the more expensive magazines. In other words, an increase in reader homogeneity in terms of age is more valuable for expensive magazines than for the less expensive ones.

Finally, we also find that advertisers have a taste for reader homogeneity in income. This result is robust across quantiles as well. The income–ad rate profile is again steeper for higher quantiles of the ad rate distribution. Overall, our estimation results are consistent with the notion that more homogenous groups of readers increase advertisers’ willingness-to-pay.

Our central result is reinforced in Table 5 where we include our HHI measures, along with mean values for each demographic, instead of the linear and quadratic terms. For all three demographic variables, the HHI measures are positive, and highly significant, in the linear specification as well as in the quantile regressions.

The coefficients on the HHI measures are also generally stable across the various quantiles, suggesting that reader homogeneity is valued across the distribution of magazine advertising prices. There are only small differences in the valuation of concentration across quantiles. Homogeneity in age appears to become less valuable as ad rates rise; however these differences are statistically significant for only a few interquantile comparisons. The opposite is true for income concentration where more concentration is associated with even higher ad prices for the more expensive magazines. This result can also be seen in Table 4, where the U-shape relationship for income is particularly steep at higher quantiles. These interquantile differences are almost all statistically highly

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<sup>24</sup>When collapsing data into two or three categories we use cutoff rules that correspond most closely to uniform divisions of the aggregate data into these categories. Nevertheless, the basic feature of U-shaped advertising prices as a function of demographics is robust to other specifications and choices of cutoffs.

	Fixed-Effects	Quantile Regressions				
		10%	25%	50%	75%	90%
Fraction Male	0.100 (0.082)	0.059*** (0.019)	0.056*** (0.012)	0.086*** (0.011)	0.098*** (0.014)	0.114*** (0.017)
HHI Gender	0.340*** (0.078)	0.333*** (0.030)	0.354*** (0.019)	0.359*** (0.021)	0.353*** (0.027)	0.284*** (0.028)
Log Mean Age	0.011 (0.103)	0.185*** (0.037)	0.056*** (0.021)	-0.019 (0.023)	-0.058** (0.027)	-0.107*** (0.035)
HHI Age	0.523*** (0.107)	0.628*** (0.059)	0.570*** (0.036)	0.479*** (0.039)	0.532*** (0.045)	0.484*** (0.060)
Log Mean Income	0.215** (0.091)	0.475*** (0.065)	0.396*** (0.043)	0.243*** (0.047)	0.227*** (0.050)	0.177*** (0.060)
HHI Income	0.317*** (0.111)	0.022 (0.112)	0.187*** (0.063)	0.381*** (0.075)	0.597*** (0.090)	0.644*** (0.094)
Share Subscriptions	0.106 (0.067)	0.027 (0.026)	0.074*** (0.016)	0.100*** (0.016)	0.150*** (0.021)	0.157*** (0.024)
Share Freistücke	-0.120** (0.048)	-0.128*** (0.026)	-0.100*** (0.016)	-0.109*** (0.015)	-0.151*** (0.017)	-0.206*** (0.025)
No. of Mags in group	-0.002 (0.002)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Log Total Pages	-0.048*** (0.018)	-0.020** (0.008)	-0.036*** (0.006)	-0.057*** (0.006)	-0.077*** (0.008)	-0.095*** (0.011)
Estimated FE	-	0.941*** (0.009)	0.969*** (0.005)	0.990*** (0.005)	1.034*** (0.007)	1.074*** (0.008)
Constant	14.43*** (0.895)	11.62*** (0.537)	12.80*** (0.356)	14.36*** (0.373)	14.70*** (0.398)	15.49*** (0.504)

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Robust SEs for Fixed-Effects regression, and bootstrapped SEs for quantile regressions are presented in parentheses. All regressions include year, quarter and magazine fixed-effects and use 6149 observations on 182 magazines.

Table 5: Regression of Log Advertising price per 1000 readers: HHI specification

significant, in both Tables 4 and 5.

For a sub-sample of our data we also have information on the labor force status of individuals. There are four categories of this variable: In-training, employed, retired, and being out of the labor force. Results using this variable also indicate that homogeneity in labor force status is valued by advertisers; we do not report those results here.

## 4.2 Other results

Results for other variables also accord with our expectations. The coefficients on the sales components terms indicate that subscription-based sales are generally more desirable to advertisers than sales at kiosks or news-stands, which is the omitted variable.<sup>25</sup> Freistücke, or free copies, are clearly the least desirable to advertisers. This is intuitive, given that Freistücke are typically found at airports, or at locations such as doctor’s practices (where they are read by a very heterogeneous audience). This is also in line with observations in the newspaper industry where free newspapers generally charge lower advertising prices per reader.<sup>26</sup>

The total number of pages has a negative and statistically significant effect on advertising rates. This is indicative of the ‘crowding-out’ effect whereby advertisers are concerned about their ads being overlooked by readers as the size of the magazine increases. This effect has been documented in other studies of media markets; see Rysman (2004) and Chandra (2009). Finally, all specifications suggest that magazines with more rivals in the same category have lower advertising prices.<sup>27</sup>

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<sup>25</sup>The coefficient on the subscription share is largest for the highest advertising rates. This indicates that advertisers in the more expensive magazines have a stronger taste for a loyal readership than advertising clients of cheaper magazines.

<sup>26</sup>This is because consumers who are given free copies of the newspaper or magazine do not necessarily read it, in contrast to those who are willing to pay even a small amount to acquire the publication.

<sup>27</sup>We also tried using different methods of calculating the degree of competition faced by a magazine. We constructed distance measures of the difference between the demographic characteristics of a given magazine and those of its nearest rival. Results using these measures are also similar.

### 4.3 Robustness checks

While the variables measuring competition and the number of pages are not of direct interest, one concern may be that these measures are endogenous, and that this can affect the estimation of our main variables of interest. For example, the total number of pages in the magazine rises with the amount of advertising, which is jointly determined with the ad price. For this reason, we expect a negative relationship between ad prices and the total number of pages, not just because of the crowding-out effect, but also because of the downward sloping nature of the advertising demand curve.

In Table 6 we present results using instrumental variables for the endogenous variables. For the competition variable, we instrument using the total population in a magazine's readership target group, by age and gender. For the number of pages, we use as instruments the average number of pages in magazines of the same publisher in other magazine segments, and the average number of pages in magazines of other publishers in the same segment. We confirm that the instruments have identifying power by using an F test for the instruments in the first stage regressions. Likewise, J-tests for over-identification do not reject orthogonality.

Once we instrument, the endogenous variables lose their statistical significance. This suggests that our estimates for these variables in the earlier specifications were biased. For example, the endogeneity of the number of pages described above would lead to a bias away from zero for its estimated coefficient. After instrumenting we find that this effect is indeed corrected. Moreover, it appears that the bias generated by the endogenous variables also affected the coefficients on our variables of interest — by biasing them downward. The results of Table 6 indicate that targeted advertising is even more valuable than our earlier estimates had suggested. This is because the polynomial specification indicates steeper U-shaped curves than we had earlier estimated. Furthermore, all the HHI measures have larger coefficients than before.

Figure 1 plots the marginal effects of each demographic characteristic using our estimated coefficients from Column 1 of Table 6. The effects at a zero share of each variable have been normalized to zero. The Figure clearly shows the U-shaped effect that age,

	(1)	(2)
	Polynomials	HHIs
Fraction Male	-0.640*** (0.187)	0.188* (0.099)
Frac. Male Square	0.859*** (0.200)	-
Fraction Age 14-49	-1.034*** (0.375)	-
Frac. 14-49 Square	0.841*** (0.294)	-
Income below 2000	-1.112*** (0.352)	-
Inc. less 2000 square	1.101*** (0.411)	-
Share Subscriptions	0.170** (0.080)	0.173** (0.081)
Share Freistücke	-0.098* (0.057)	-0.091 (0.058)
HHI Gender	-	0.420*** (0.099)
Log Mean Age	-	0.113 (0.120)
HHI Age	-	0.640*** (0.179)
Log Mean Income	-	0.255*** (0.096)
HHI Income	-	0.382* (0.195)
No. of Mags. in group	0.030 (0.021)	0.032 (0.022)
Log Total Pages	0.015 (0.161)	-0.025 (0.175)
Constant	16.338*** (0.767)	12.755*** (1.396)

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Robust SEs in parentheses.

All regressions include year, quarter and magazine fixed-effects and use 6149 observations on 182 magazines.

Table 6: Fixed Effects IV Regressions of Log Advertising price per 1000 readers: Polynomial and HHI Specifications

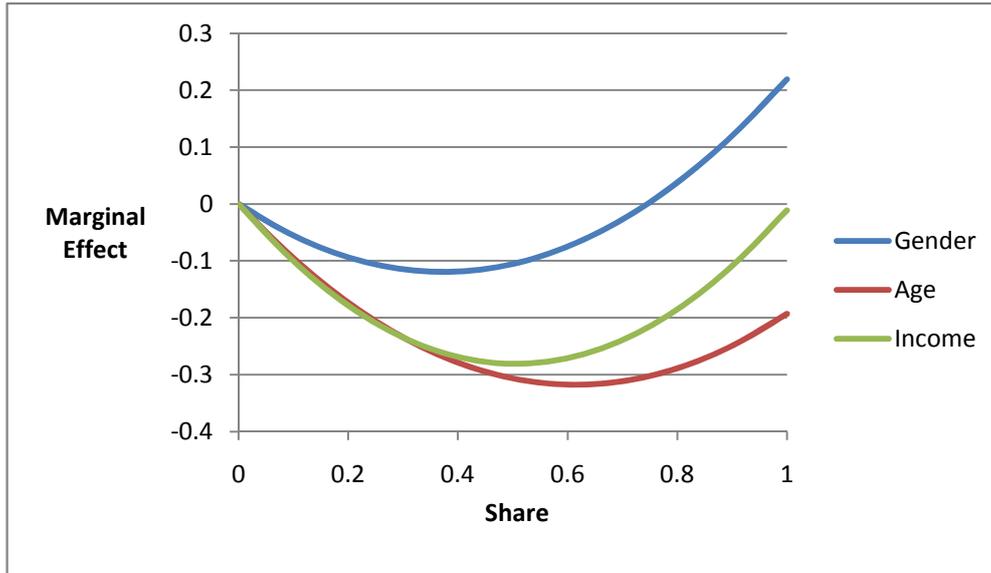


Figure 1: Marginal Effects of demographic variables on per-capita advertising prices.

gender and income have on advertising prices per reader.

All the regressions in Tables 4, 5 and Table 6 include other variables, whose coefficients are not reported: magazine, year and quarter fixed effects. Our results are also robust to excluding the endogenous variables, namely competition and the number of pages in the magazine, as well as running the regressions without magazine fixed-effects. The results also remain significant in fixed-effects specifications where the standard errors are clustered by magazine-year.<sup>28</sup>

To summarize our regression results, we find strong evidence of the importance of targeted advertising. The homogeneity of readers according to gender, income and age is valuable, and increases equilibrium advertising prices. This is true in both specifications and holds across most quantiles. The estimation results based on the polynomials and the HHI measures should be — and indeed are — very similar: the evidence for advertisers' valuation of reader homogeneity based on the the HHI measures (i.e. positive coefficients), is consistent with a U-shaped relationship of the related variable with advertising prices, which means that its effect is maximal for extreme values of the corresponding reader characteristic. All of our results are intuitive and in line with our prior expectations.

<sup>28</sup>The results of these and other robustness checks are available from the authors upon request.

## 4.4 Discussion of results

What would be an ad-rate maximizing policy for a magazine that could, in principle, directly choose its reader characteristics? The answer clearly is that it should target an audience that is homogenous in terms of gender, age and income. This main result holds for all specifications and across all quantiles. To be clear, this result holds other characteristics constant; most importantly, total circulation. We do not suggest, for example, that a magazine which decides to increase its targeting of female readers should necessarily try to reduce the number of male readers.

Going by the results of Table 6, we can calculate how much targeted advertising increases advertising prices by considering counterfactual extreme cases. Compare a situation of a magazine that is read equally by men and women, with one that is read entirely by men. *Ceteris paribus*, the latter case allows the magazine to charge per reader advertising prices that are around 32% higher than in the former, as measured by the polynomial specification. The estimated premium is 30% using the HHI specification.<sup>29</sup>

The results are even more striking for age. Advertising prices for a magazine with an equal age distribution of readers across three broad categories are 43% lower than for a magazine that has all its readers concentrated in just one of those three categories.

Our estimation results differ across quantiles in terms of the ‘level effects’ of gender, age and income. This helps us answer the question of which types of readers magazines should cater to, independent of the homogeneity benefits of targeted advertising. In particular, is it more valuable to have readers that are male or female, younger or older, and high- or low-income? The answer is clear for gender and income: advertisers pay a premium for male readers with a high income. It is not as clear for age, where it depends on the point in the ad rate distribution the magazine is situated. As can be seen from Table 5, older readers are preferred by magazines at the lower end of the advertising price distribution, while the reverse is true for those at the higher end of the distribution.

We explain this finding by pointing out the difficulties faced by advertisers in reaching

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<sup>29</sup>As stated earlier, the least valuable gender mix is in fact when the male fraction is around 41%, rather than 50%. This is because the higher value that the average male reader appears to command slightly offsets the lower value from having equal numbers of male and female readers.

particular consumers using alternative advertising outlets. For example, typical “cheap” magazines are TV magazines which cater to older readers with a lower income; these readers are also hard to reach through other media such as the Internet. Some advertisers want to reach exactly these readers and are willing to pay a higher premium for age and income homogeneity than for more expensive magazines which typically have younger and more affluent readers. Typical genres here are Lifestyle and Business, Politics and Finance magazines.

## 5 Conclusion

In this paper we have established the importance of targeted advertising in magazine markets. Targeted advertising is an important phenomenon, with rapidly growing potential, due to the evolving nature of media. Previous research has acknowledged the importance of this practice, but has paid little importance to analyzing the intermediary role of the media, or to empirically determining the value of targeted advertising.

We show that targeted advertising is extremely valuable in the magazine industry. Our work adds to similar findings in other contexts, but uses more appropriate data and fewer assumptions. Our results indicate that magazines which reach more homogeneous readers, as measured by income, age and gender, have higher equilibrium advertising prices, holding other characteristics constant. These results are consistent with advertisers being willing to pay more to directly target their preferred demographics.

Our results have implications for the evolving nature of media industries and, particularly, the role of advertising in generating change in these industries. The high value that advertisers place on reaching their preferred target audience requires media companies to be vigilant in adopting new technologies that better serve their clients.<sup>30</sup> This explains strenuous attempts by the media to retain their existing audiences — as well as generate new ones — when moving online. The possibilities of targeting with online media are vast, and this is likely to create challenges for traditional media which do not have the

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<sup>30</sup>Note that targeting may be incompatible with other methods, such as greater visibility, as found by Goldfarb and Tucker (2010).

same ability to deliver precisely constructed audiences to their advertisers.

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