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Ambarish Chandra, Ulrich Kaiser

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Targeted Advertising in Magazine Markets and the Advent of the Internet

Ambarish Chandra
Department of Economics, University at Albany, Albany, New York 12222; and Department of Management, University of Toronto, Toronto, Ontario M5S 3E6, Canada, ambarishchandra@gmail.com

Ulrich Kaiser
Department of Business Administration, University of Zurich, 8032 Zurich, Switzerland; ZEW Centre for European Economic Research, 68161 Mannheim, Germany; Centre for Industrial Economics, University of Copenhagen, 2000 Frederiksberg, Denmark; and Institute for the Study of Labor, 53113 Bonn, Germany, ulrich.kaiser@business.uzh.ch

This paper examines how the ability of traditional media firms to engage in targeted advertising has changed with the advent of the Internet. We find that the premium for reaching a homogeneous audience increases for magazines that have a companion website, as well as for those whose readers are more likely to be online. This indicates a complementarity between offline and online channels with respect to targeted advertising. We hypothesize that this result is driven by multihoming consumers who enhance the value of targeted advertising, in contrast to the usual assumption that multiple advertising messages are redundant.

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1. Introduction

The advent of the Internet over the past two decades has posed significant challenges to traditional media firms. Two phenomena in particular have greatly affected print media such as newspapers and magazines. First, consumers have substituted away from print media toward online content, with advertisers following suit. Second, print media have tried to stem the loss of subscribers by launching electronic versions of their print content—usually in the form of companion websites, but occasionally also as applications for mobile devices. However, this electronic content is often discounted or free, and therefore may end up cannibalizing the traditional revenue model of these media companies. Thus, some have argued that print media may be contributing to their own demise by their attempts to retain readers.[1]

These factors have contributed to recent newspaper closings and layoffs, most notably in the United States.[2] The primary reason for this is the steep decline in advertising revenues for print media.[3] It is not surprising that lower subscriber numbers will directly reduce advertising revenues. But another reason cited for the decline of traditional media is their relatively inefficient ability to practice targeted advertising, as compared to online media (Bergemann and Bonatti 2011). Targeted advertising is the ability to show advertising to the most receptive audiences, and online advertisers can use sophisticated methods to target consumers.[4] These methods are generally not available in traditional media.

This paper asks the following question: How has increased competition from online media—through the growth of both companion websites for print publications, as well as of Internet use among readers—affected the value of targeted advertising in traditional print media? On one hand, the more sophisticated targeting capabilities of online media may have induced advertisers to switch away from targeting via traditional channels. On the other hand, there may be complementarities between targeting consumers via both online and offline media. Our results support the latter effect. In particular, the results are consistent with the notion that targeting in print magazines becomes more valuable when a greater number of readers are likely to *multihome*, i.e., consume more than one media source.

[1] See, for example, Seelye (2005).

[2] See *USA Today* (2009).

[3] Newspaper ad revenues dropped by 50% over the period 2009 to 2013, and by 66% over the previous decade (Newspaper Association of America 2013a).

[4] See Plummer et al. (2007) for a summary of various techniques available to online advertisers for identifying and targeting consumers.

Our paper relates to three lines of research. First, there is a theoretical literature that models competition across media channels for consumers. Two recent papers conclude that increased online competition can either raise or lower advertising prices offline, but neither study allows for the possibility of advertising complementarity across channels. Bergemann and Bonatti (2011) explicitly model multiple advertising messages as being redundant. They assume that online media can target better than offline media, and show that increased competition from online sources has ambiguous effects on advertising prices. Athey et al. (2013) also assume that multihoming by consumers will lead to an increase in wasted impressions by advertisers. The effects of consumer multihoming in their model also has unclear effects on the price of advertising; in this case, the reason is that the effects depend crucially on technology and the extent to which advertisers can utilize tracking tools to reduce duplication.

A second line of research has empirically measured the effects of targeted advertising online; however, it is mostly focused on how targeting impacts the decision to purchase the advertised product, as opposed to our focus on the outcomes for media firms. Goldfarb and Tucker (2011a) show that online targeting increases ad effectiveness. Goldfarb and Tucker (2011b) confirm this result, but also show that if consumers find the ad to be obtrusive, then online targeting can actually decrease the likelihood of purchasing the product.

Another set of studies empirically examine the interaction between the Internet and print media, but have generally focused on the circulation side of the industry and, in particular, on the cannibalization of print circulation by the presence of online companions. These studies usually find that online and offline channels are substitutes; however, the most recent study, by Liebowitz and Zentner (2012), finds that the substitution effect of the Internet is moderate.[5]

Only a few studies have examined the effects of the Internet on advertising in traditional media. Zentner (2012) shows that advertising budgets in traditional media have decreased in countries with higher rates of Internet use. In addition, two recent papers by Goldfarb and Tucker (2011c, d) conclude that the Internet is a substitute to offline advertising, although they do not specifically examine targeted advertising. Their results suggest that online advertising for certain goods is either more effective or higher priced in those jurisdictions where offline advertising is not permitted, thereby indicating that offline and online channels for these goods are substitutes.

[5] See also Filistrucchi (2005), Gentzkow (2007), Simon and Kadiyali (2007), and Kaiser and Kongsted (2012).

Our paper makes three distinct contributions to the literature. First, it is, to the best of our knowledge, the first study to empirically show that online and offline channels may be complements with regard to targeted advertising. This is an especially important finding because most recent theoretical work models them as being substitutes, as multiple advertising messages are assumed to be redundant. Second, the existing empirical studies of possible online complementarities examine the demand for online advertising when the offline option is either unavailable or restricted to advertisers (Goldfarb and Tucker 2011c, d). By contrast, we examine the question of advertising complementarity for all goods, with no specific focus on those that face advertising bans. Since the vast majority of goods can be freely advertised in all media, our results provide a more general estimate of the extent to which offline and online channels may complement or substitute for each other.

Third, we make an important contribution by relating the question of substitution in media to multihoming by consumers. Whether advertisers view different media channels as substitutes or complements depends to a large extent on the behavior of subscribers. As more consumers multihome across various media, there exists the possibility that advertisers view those different media channels as complements rather than substitutes due to the potential for cross-media advertising campaigns. Our results suggest that this is indeed the case.

The setting for our analysis is the German magazine industry, one of the largest magazine markets in the world, as measured by the number of titles. This industry provides externally audited data on the characteristics of readers at individual magazines, as well as data on whether or not magazines have launched companion websites and the extent to which readers use the Internet. Our data source gives us access to exactly the same information that advertisers have when they make decisions about how to allocate their advertising budgets. To our knowledge, no prior analysis of advertising markets has had access to such detailed, firm-level data on readers. We measure the importance of targeted advertising by estimating the extent to which demographically homogeneous readers raise advertising prices; previous authors, including Chandra (2009) and Goettler (2012), have shown that homogeneous audiences command a premium in media markets. We then examine whether magazines' ability to target advertising has become more or less valuable as magazines launch companion websites to retain readers, and as their readers increasingly consume online content.

It is now clear that aggregate advertising prices have declined in real terms as print media have lost readers to the Internet; this has been established

by the sources cited above, and is also apparent in our own data. The more interesting relationship is the one between the Internet and ad prices that are adjusted for circulation. We show that even *per-reader* advertising prices have declined with the advent of the Internet, suggesting that print media have suffered advertising declines disproportionate to their loss of subscribers. However, we also show that magazines that reach demographically similar audiences have higher advertising prices and that this relationship has strengthened with the advent of the Internet. In particular, the premium for demographically homogeneous audiences increases with the presence of magazines' companion websites, as well as in the degree of Internet use of a magazine's readers. These results are consistent with the hypothesis that offline and online methods of targeting consumers are complements, rather than substitutes.

What is the mechanism by which online and offline channels may in fact be complements? One possibility is that being exposed to ad campaigns for the same brand or product across multiple channels reinforces the message in the minds of consumers. For this reason, advertisers may find it more valuable to reach consumers through a diverse number of channels than through just a single channel, leading to advertisers preferring consumers who multihome across different media. This may especially be the case if advertising requires multiple contacts with consumers to have an appreciable impact, in contrast to a common assumption in the literature that a single message is sufficient. We provide support for this hypothesis with additional results indicating that a magazine's advertising prices are higher when its readers are more likely to consume other media in general, not just online media. We also present examples from magazine fact sheets, aimed at advertisers, which highlight the desirability of cross-advertising across the magazine's print and electronic editions.

Our results support previous findings of advertising complementarities across media, even though these studies tend to focus on individual goods for which sales or consumption data are available, and therefore use methods different from ours. For example, Naik and Raman (2003) report "synergies" between print and television advertising for a particular clothing brand. More recently, Naik and Peters (2009) showed that such complementarities exist among offline media advertising—television, radio, and print—for a particular car model. Moreover, they also exist between online and offline media advertising for the same product. In addition, Zigmond and Stipp (2010) and Joo et al. (2014) report that television advertising impacts consumer search behavior online, and in particular, that viewing an advertisement on TV makes consumers more likely to search for the advertised product or brand online.

Our results appear to contrast with those of Goldfarb and Tucker (2011c, d), which conclude that the Internet is a substitute to offline advertising. However, our results can be reconciled with theirs in at least two ways. First, the offline channels that Goldfarb and Tucker (2011c, d) consider are either out-of-home channels such as billboards and transit, or direct channels such as email, whereas the offline industry that we examine is a traditional media channel: print magazines. Second, Goldfarb and Tucker (2011c, d) show that when offline advertising for specific products—alcohol and law services respectively—is not permitted, firms increase online advertising instead. By contrast, our results hinge on the behavior of consumers, rather than on legal restrictions, and are based on examining media channels where consumer multihoming is likely and where firms can freely advertise.

An interesting feature of the magazine industry is that it has not been affected as severely by the advent of the Internet, or by recent economic volatility, as has the newspaper industry. Magazine advertising revenue in the United States grew by 3.1% in 2010, compared with a decline of 8.2% in the same year for U.S. print newspapers. Magazine readership in the United States has grown by 4.3% in the past five years, whereas newspaper circulation has declined by more than 10% over the same period.[6]

In the next section we present the data used in our analysis. The empirical specification is discussed in §3. Section 4 contains our main results as well as supporting evidence to explain the mechanism that drives the results. We conclude in §5.

2. Data

We use data on the German magazine industry, obtained from Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V. (IVW), which is the German equivalent to the Audit Bureau of Circulation in North America.[7] IVW ascertains,

[6] See MediaMark Research (2013), Publishers Information Bureau (2013), and Newspaper Association of America (2013b). The German magazine industry has seen recent circulation declines and is not as healthy as the U.S. market. Nevertheless, there is still net entry into this market; the total number of magazine titles in Germany has increased by 3.2% over the period 2004–2009 (VDZ 2010). German newspapers, by contrast, have had even greater circulation declines, and a 7.4% decrease in the number of titles (KEK 2009).

[7] The original data source is the "Information Association for the Determination of the Spread of Advertising Media" (Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V.). The data have been updated quarterly since 1972 and are continuously recorded. The core data is publicly available and downloadable from http://www.medialine.de/deutsch/wissen/zeitschriftendatenbank.html.

monitors, and publishes information on magazine circulation and total readership. Our core data set consists of information on the total number of copies sold, advertising and content pages, market reach (the number of people who read, but do not necessarily buy, the magazine), advertising rates, and copy prices. Advertising rates are broken down by black and white, two-color, and four-color advertisements.

We supplement our core data with information on readership characteristics that was collected 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 composition of readers with respect to gender, age, and household income.

The AG.MA data are notable for the fact that the available information on reader characteristics is the same information that is made available to advertisers. Advertisers purchase the AG.MA data to determine the readership profile of magazines and to allocate their advertising budgets accordingly. We are fortunate to have obtained access to the very same database, and therefore we have exactly the same information that advertisers do when they make their decisions.[8] To our knowledge, such detailed data are not available in any other media market. Note that we have no information on the geographic location of readers: such data are not available in the magazine industry unlike, say, the newspaper industry. Therefore, we rely on variation in readers' demographics to arrive at our results.

AG.MA also collects data on Internet use at each magazine, which is a key variable of interest for us. We obtained data on the fraction of readers at each magazine who regularly use the Internet during the past three months.[9] Finally, we collected data for each magazine on whether the publication also had an online version in the corresponding quarter. These data were first used by Kaiser (2006) and were obtained by documenting the existence of magazines' companion websites. The respective launch dates were obtained from press releases or by directly contacting the publisher. We have updated the website data for use in this paper.

[8] We cannot rule out the possibility that certain advertisers conduct additional research into the readers at their preferred magazines, through mail-in surveys for example. Nevertheless, the AG.MA data are without doubt the only source used by the majority of firms in Germany who consider purchasing magazine advertising.

[9] Although we do have information on readers' Internet use within more narrow time spans for recent years, only quarterly use data are available for the entire time span of 1998 to 2010 that we consider. Based on the data that we have, the correlation of Internet use across various time spans is very high.

Table 1 Summary Statistics on Magazine Characteristics

	Mean	SD	Min	5%	95%	Max
Total sales per quarter (1,000s)	426	450	13	98	1,463	2,869
Total reach (1,000s)	1,484	1,479	130	330	5,250	8,010
Total pages per quarter	821	543	104	244	1,778	4,740
Ad pages per quarter	218	234	4	39	640	2,336
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	0.50	1	1
Black/white ad rate (1,000 euros)	14.80	9.51	2.00	3.40	33.80	54.00
Color ad rate (1,000 euros)	17.78	11.19	2.20	4.30	43.10	54.50
Website	0.30	0.46	0	0	1	1
Dep. var.: log(ad rate/1,000 readers)	2.63	0.62	0.59	1.68	3.62	4.85

Notes. Each observation is a magazine-quarter-year. $N = 6{,}002$.

The AG.MA data are not available for, depending on the period, between 7.1% and 39.4% of the magazines in our core data set. Magazines need to pay AG.MA 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%.

Table 1 contains information on magazine characteristics such as sales, the number of pages, 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. 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 market reach for each magazine which is, on average, over three times the magazine's paid circulation. On average, 30% of the magazines in our sample had a Web edition in a given quarter, as indicated by the *Website* variable. Finally, the last line of the table summarizes data on our constructed dependent variable, the log of the advertising rate per 1,000 readers, on which we provide more details in the next section.

Table 2 contains summary statistics 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 either gender. A slight plurality of readers are "prime age," as advertisers call people aged

Table 2 Summary Statistics on Demographic Data

	Mean	SD	Min	5%	95%	Max
Male	0.39	0.27	0.02	0.07	0.87	0.97
Age						
14–29	0.25	0.19	0	0.06	0.73	0.90
30–49	0.38	0.11	0.1	0.19	0.54	0.71
50+	0.37	0.20	0	0.05	0.70	0.83
Household income (euros per month)						
Below 2,500	0.66	0.12	0.22	0.46	0.84	0.94
2,500 or more	0.34	0.12	0.06	0.16	0.54	0.78
Constructed HHIs						
Gender	0.67	0.13	0.50	0.50	0.88	0.96
Age	0.43	0.09	0.33	0.35	0.63	0.82
Income	0.58	0.07	0.50	0.50	0.73	0.88
ShareOnline	0.41	0.27	0.00	0.03	0.86	0.96

Notes. Each observation is a magazine-quarter-year. $N = 6{,}002$.

30–49 years, constituting almost 40% of all readers. Over a third of all readers have a monthly household income above 2,500 euros, 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 variables that we use to measure homogeneity of magazine readers. These are values of the Herfindahl–Hirschman Index (HHI) for each demographic. The HHI is the sum, across categories, of squared values of each demographic variable. HHI values closer to 1 indicate greater homogeneity, whereas values closer to 0 indicate greater diversity of characteristics. Gender appears to have the highest concentration on average, but concentration by gender also varies the most of all three demographic variables. Finally, Table 2 indicates that 41% of readers at the average magazine were regular Internet users, as measured by the *ShareOnline* variable.

The two measures of the advent of the Internet—*Website* and *ShareOnline*—are critical components of our empirical analysis. We emphasize the fact that there is considerable cross-sectional and temporal variation in these measures, which permits us to identify the effects of the advent of the Internet. In particular, the fraction of magazines with a companion website has increased from about 20% to almost 50% over the 12-year sample period. Internet use by consumers has grown more rapidly over this period, from 3% to about 70%. Interestingly, in the early years of the sample there was a greater likelihood of a magazine having a website than of its median reader being a regular Internet user, but the reverse was true by the end of the period. This slower growth in magazine websites is possibly due to a resistance by some publishers to give away their content online and potentially cannibalize their print editions.

3. Empirical Approach

3.1. Regression Specification

Our goal is to estimate the relationship between the characteristics of magazine readers—and in particular, the potential for targeted advertising given these characteristics—and the willingness to pay by advertisers. The latter is represented by the equilibrium advertising rate at each magazine.[10] As discussed in §1, magazines with larger market reach will naturally have higher advertising rates; moreover, the Internet has unambiguously reduced the market reach, and hence advertising rates, of print publications. In our data, for example, total magazine sales declined by 20% during the period 1998–2010. Our goal in this paper is not to explain the decline in magazine sales, but to examine how the advent of the Internet has affected the value of advertising adjusted for circulation. We therefore develop a model of advertising prices per reader. Note that advertising rates in media industries are generally quoted as the price per thousand subscribers (ad rate relative to market reach), which implies that the total value from advertising is proportional to the number of readers.[11]

We use the homogeneity of readers at each magazine to measure the potential for targeted advertising. These measures are the constructed HHI variables that were described in the previous section. We also include the demographic characteristics of readers, measured in levels, as control variables. The logic is that magazines with more similar readers should be able to charge higher advertising prices, holding constant other characteristics such as the mean demographics of these readers.[12]

Our base regression specification takes the following form:

$$R_{kt} = \alpha + \mathbf{\Theta H}_{kt} + \mathbf{\Gamma D}_{kt} + \epsilon_{kt}, \tag{1}$$

where R_{kt} is the advertising rate per reader at magazine k in time period t, $\mathbf{H}$ is a vector capturing the homogeneity of readers, $\mathbf{D}$ is a vector representing the mean demographics of the magazine's readers, and $\mathbf{\Theta}$ and $\mathbf{\Gamma}$ are coefficient vectors. Unobserved factors that may affect equilibrium advertising rates are contained

[10] It is straightforward to show that magazines that generate greater willingness to pay by advertisers will have higher advertising prices in equilibrium, regardless of the competitive nature of the industry. See the appendix for a more detailed discussion.

[11] 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 rates per subscriber; see Rysman (2004).

[12] Another way to measure reader homogeneity is simply to include a second degree polynomial in each demographic. Results using this measure were presented in an earlier version of this paper, and are consistent with the HHI measures of homogeneity.

in ϵ_{kt}. Note that this specification is very similar to the one used by Chandra (2009). As shown in that paper, a regression of advertising rates on the characteristics of media subscribers will yield consistent estimates, since the right-hand side variables represent demand shifters and are not endogenous from an econometric standpoint. Moreover, this reduced form estimating equation can be derived regardless of the competitive nature of the industry.

We define the dependent variable as the log of the advertising rate per 1,000 readers; see Table 1 for summary data on this variable.[13] 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.[14] The distribution of advertising rates per reader is heavily skewed, so we employ its natural logarithm as our dependent variable.

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 U.S. media companies. For example, CBS, ABC, NBC, and Fox set advertising rates in the spring for advertisements appearing in the fall (Gal-Or and Dukes 2003, Goettler 2012). We take this specific feature of the German magazine market into account by leading our dependent variable by one year.[15]

It is important to note that we do not include magazine characteristics such as content, quality, or copy prices as regressors in Equation (1). These variables should only affect advertising rates per reader through their effect on market reach. We have already conditioned on market reach by using it to normalize advertising rates as the dependent variable. When we do include measures of content or quality on the right-hand side, the estimated coefficients were not statistically or economically significant. This confirms a similar finding by Koschat and Putsis (2002).

One concern regarding our dependent variable may be that we rely on the list price of advertisements, rather than on the transaction price. Advertisers may receive discounts from the list price (sometimes referred to as the "rate card price"), and these may be bigger for frequent advertisers, or those who buy bulk advertising space across various media. According to industry participants, advertising rates almost never deviated from list prices during the period we consider, an observation that is in accordance with Koschat and Putsis (2002), who find a correlation between transaction prices and list prices of 0.98 in their data for the United States. As a practical matter, there is no direct solution to this in our analysis, as transaction prices are rarely revealed.[16] Nevertheless, the results of our analysis will not be affected as long as transaction prices are generally proportional to list prices. In fact, we require an even weaker assumption: that deviations of transaction prices from list prices are not systematically correlated with the demographics of subscribers.

Equation (1) estimates the extent to which targeted advertising is valuable in magazine markets. However, our primary empirical exercise is to examine whether the advent of the Internet has *changed* the value of targeted advertising in traditional media markets. Accordingly, we estimate a modified version of Equation (1) where we interact reader homogeneity with two separate variables that measure how the Internet has potentially affected print media. These variables are *Website* and *ShareOnline*, which were defined in §2. Note that the former variable is binary, whereas the latter is continuous. We interact these measures of Internet activity with the HHI variables that capture the potential for targeted advertising. Letting *Internet* denote either *Website* or *ShareOnline*, our main regression specification is

$$\begin{aligned} R_{kt} = {} & \alpha + \beta_1 HHIGender_{kt} * Internet_{kt} + \beta_2 HHIIncome_{kt} \\ & * Internet_{kt} + \beta_3 HHIAge_{kt} * Internet_{kt} + \mathbf{\Theta H}_{kt} \\ & + \mathbf{\Gamma D}_{kt} + \delta\, Internet_{kt} + \epsilon_{kt}. \end{aligned} \tag{2}$$

The estimated β_i coefficients indicate the extent to which targeted advertising in print magazines has been affected by the advent of the Internet: either website presence or the share of readers that are online. Positive coefficients will indicate a complementarity between online and offline channels

[13] We also estimated regressions where we normalized advertising rates by the number of copies sold, rather than by the number of readers of the magazine. The two measures are, of course, highly correlated, and the results do not differ much.

[14] 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% 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.

[15] 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 leading values.

[16] Moreover, even for the transacting parties, the actual transaction price is often hard to determine until well after the transaction, since there are cases where the media firm provides free or discounted advertising space to make up for a shortfall in the estimated number of readers at the time the contract was written.

with regard to targeted advertising, whereas negative coefficients will suggest that these channels are substitutes.

3.2. Identification

The introduction of the Internet variables—*Website* and *ShareOnline*—in Equation (2), and their interaction with the HHI measures, creates a potential identification problem. These variables may not be exogenous from an econometric standpoint since they may be correlated with ϵ_{kt}, i.e., with unobserved factors that influence ad prices, beyond the other controls in the regression. We discuss the potential endogeneity, and possible solutions, for each of these variables in turn.

The endogeneity of *Website* seems quite likely since magazine publishers control the price of advertising as well as the decision to launch a website. In particular, launching a website represents both a benefit as well as a cost to publishers, since doing so can potentially retain readers who might be attracted to other online media, but can also directly cannibalize revenues from the print edition. Thus, only certain types of magazines are likely to launch companion websites, implying self-selection by publishers. This should bias the estimated effect of *Website* towards zero, if those magazines that launch a Web edition are less likely to suffer advertising losses in their print editions.

To properly identify the causal effect of *Website*, we require instrumental variables. These instruments need to be correlated with the endogenous variable, as well as orthogonal to the error term in the equation of interest. The instruments we employ are (i) the number of companion websites of magazines published by the other publishers in the same magazine category relative to the total number of magazines in that category and (ii) the number of companion websites that the same publisher maintains relative to the total number of magazines that firm publishes; we use lagged values of these variables.[17]

The intuition behind the first instrument is that an important driver of the decision to launch a website may be "bandwagon effects"; publishers may feel pressured to launch websites because competitors do so. The intuition behind the second instrument is that the publisher's costs of launching an additional website will decrease the higher the fraction of its other magazines that have companion websites. Thus, we expect that these instrumental variables will be correlated with the magazine publisher's decision to launch a website, but believe it is quite unlikely that either variable will be correlated with unobserved magazine-specific effects that would affect advertising rates. In other words we do not expect the instruments to have any effect on a magazine's print advertising rates, other than through their effect on the magazine having an online edition.

The endogeneity of *Website* also renders the interactions of this variable with the HHI variables endogenous, as pointed out by Wooldridge (2002, p. 234). To instrument these interactions, we follow Wooldridge (2002, Chap. 9) and interact the instruments with the exogenous variables. We estimate our equations of interest by a generalized method of moments (GMM). This means that we apply a linear instrumental variables technique despite the companion website presence being measured as a dummy variable. We do so to avoid problems associated with misspecification that are particularly prevalent in nonlinear instrumental variable models compared with linear ones (Angrist and Krueger 2001, Angrist and Pischke 2009).

The validity of instruments is usually informally tested by *F*-tests for joint significance of the instruments in "first-stage" regressions. The corresponding test statistics should exceed 10 (Stock et al. 2002). There is of course no "first-stage" regression in GMM, so we run simple ordinary least squares regressions of our endogenous variables on our exogenous variables as well our instruments. Our smallest *F*-statistic is 34 (for the interaction between the HHI for gender and *Website*), implying that our instruments are highly correlated with the endogenous variables. This is as expected, given the reasoning above. As we will show in the next section, these instruments also work in the direction that accords with intuition, by addressing the downward bias in *Website*.[18]

Turning to the *ShareOnline* variable, it is possible that there are certain characteristics of readers that affect both their Internet use, as well as unobserved characteristics ϵ_{kt}; if so, the specification of Equation (2) using *ShareOnline* may suffer from omitted variable bias.[19] What might such a characteristic be? It could be a demographic characteristic on which we do not have data, for example, education (which is, however, at least partly controlled for by the other demographic variables). But note that advertisers do not have data on such characteristics either. The key point here is that we have the same data that advertisers do, as described in §2. In this regard, we do not face the common econometric problem of having variables that are observed by agents making decisions but unobserved to the econometrician.

[17] This exercise reduces the number of observations to 5,823 from the original 6,002, due to using lagged data.

[18] We also employ the Sargan test as a check for overidentification. The *p*-values of our tests for overidentification are all well above the critical value of 0.1.

[19] It is safe to assume that reverse causality is not a concern for *ShareOnline*, unlike for *Website*, since magazine advertising prices should not affect readers' decisions to adopt the Internet.

Nevertheless, *ShareOnline* may well be an imperfect proxy for some other characteristic desired by advertisers that cannot be easily measured.[20] For example, readers with an interest in acquiring information may be more inclined to use the Internet as a source to supplement their magazine reading and other media consumption. This behavior may be valued by advertisers, which would lead to a correlation between Internet adoption and the unobserved quality components of magazine k, ϵ_{kt}.

In this case, the coefficients on *ShareOnline* and on its interactions with the HHI variables in Equation (2) will not have a direct causal interpretation. But the coefficients are still informative because they capture the overall effect on advertising prices of magazine readers being more likely to use the Internet, which encompasses the direct effect of the Internet as well as of any other characteristic that Internet use represents. The drawback is that the coefficients cannot be used to shed light on the effects of some sort of future policy change, for example, the effect of a policy to grant subscribers free or subsidized Internet access on magazine ad prices. However, they do directly answer the question that we pose in this paper: as Internet use among magazine readers has grown, what impact has it had on the returns to targeted advertising in traditional media markets?

4. Results

We now present our empirical results. We first show results from estimating Equation (1), as well as from estimating Equation (2), using *Website* as the measure of the advent of the Internet and accounting for its endogeneity. We then present the results using *ShareOnline*. Our results show a positive interaction between the Internet variables and the potential for targeted advertising in print magazines. We then discuss the implications of this result, and present corroborating evidence to support our hypothesis.

4.1. Main Results: The Effect of Companion Websites

Table 3 presents our main results. The first column presents the results of the base regression, specified in Equation (1). The estimated coefficients on the HHI measures are positive and highly significant.[21] This shows that magazines that reach homogeneous audiences have higher equilibrium advertising prices, indicating that targeted advertising is valuable in the magazine industry. This result confirms the finding of Chandra (2009) for the U.S. newspaper industry as well as of Koschat and Putsis (2000) for the U.S. magazine industry. The results are similar whether we pool observations as in column (1), or use category fixed effects as in column (2). However, the fit of the regression is better with category fixed effects, and the F-test rejects the hypothesis that category fixed effects are zero in all of our specifications. In column (3) we instead include fixed-effects for individual magazines. Doing so greatly reduces the variation available for identification since demographics do not vary much within magazines over time. This is evident from the much larger standard errors in column (3), and the fact that all of the base demographic variables, such as the share of readers who are male, are statistically insignificant. The pattern of results for the HHIs is similar to column (2), but we view the magazine fixed-effects specification as overly stringent, especially given the small R-square for this specification. For this reason, we treat the regression with category fixed effects as our preferred specification and include these going forward.

In column (4) we introduce *Website*, and in column (5) we interact this variable with the HHI measures. We first note that the coefficient on *Website* by itself is negative and significant in both columns (4) and (5). Meanwhile, the base HHI variables remain positive and highly significant in column (5), which shows that magazines without websites can earn a premium from delivering a homogeneous audience to advertisers. Moreover, the interaction of *Website* with the three HHI measures in column (5) leads to positive and highly significant coefficients. This suggests that although launching a Web edition is associated with lower print advertising revenues at the average magazine, this effect is mitigated at magazines with more homogeneous readers. The overall result indicates a complementarity between audience targeting and the presence of a website.

Column (6) of Table 3 uses instrumental variables to correct for the endogeneity of *Website* and for its interaction with the three HHI measures, since these are endogenous as well. The basic pattern of results continues to hold in column (6), although the variables of interest have coefficients of greater magnitude than in column (5). This suggests that the endogeneity of *Website* was driving the estimates toward zero, just as we had conjectured in §3.2.

The coefficients on the mean demographics in Table 3 conform to expectations as well, with the exception of those in column (3) for the reasons discussed above. The omitted age category is readers

[20] This will only be problematic if this characteristic is time varying, since our fixed effects will capture time-invariant unobserved characteristics.

[21] We do not cluster standard errors since this may lead to biased estimates of the standard errors if the panel is very unbalanced (Kézdi 2004), as is the case in our data. In fact, Rogers (1993) shows that there is little bias in standard errors if no cluster contains more than 5% of the total sample, and Cameron et al. (2006) and Kézdi (2004) show that the bias is negligible if the number of clusters is larger than 50—we have 179 clusters in our data.

Table 3 Targeted Advertising and Companion Websites

	(1)	(2)	(3)	(4)	(5)	(6)
HHI Age	0.40***	0.57***	0.62***	0.32***	0.40***	0.90***
	(0.08)	(0.08)	(0.23)	(0.08)	(0.09)	(0.30)
HHI Income	0.46***	0.92***	0.04	0.99***	0.98***	1.84***
	(0.14)	(0.16)	(0.36)	(0.16)	(0.16)	(0.55)
HHI Gender	0.25***	0.30***	0.39**	0.20***	0.16***	0.20*
	(0.05)	(0.05)	(0.20)	(0.05)	(0.05)	(0.11)
Website				−0.20***	−2.45***	−7.90***
				(0.02)	(0.16)	(2.46)
HHI Age ∗ *Website*					1.42***	4.26**
					(0.16)	(1.72)
HHI Income ∗ *Website*					1.16***	7.93***
					(0.21)	(2.62)
HHI Gender ∗ *Website*					1.55***	2.19**
					(0.10)	(1.11)
Share Male	−0.36***	−0.04	0.06	−0.06*	−0.14***	−0.08
	(0.03)	(0.03)	(0.21)	(0.03)	(0.03)	(0.13)
Share Age < 30	−0.66***	−0.48***	−0.08	−0.50***	−0.39***	−0.03
	(0.06)	(0.09)	(0.18)	(0.09)	(0.09)	(0.17)
Share Age > 50	−1.95***	−2.25***	−0.21	−2.33***	−2.12***	−1.37***
	(0.06)	(0.08)	(0.20)	(0.07)	(0.07)	(0.18)
Share Income < 2,500	−2.30***	−2.17***	−0.31	−2.35***	−2.20***	−3.19***
	(0.09)	(0.11)	(0.22)	(0.11)	(0.11)	(0.33)
Category fixed effects	No	Yes	No	Yes	Yes	Yes
N	6,002	6,002	6,002	6,002	6,002	5,823
R^2	0.48	0.51	0.22	0.52	0.55	0.56

Notes. The dependent variable is log(ad rate/1,000 readers). Robust standard errors are in parentheses. Regressions include quarter-year fixed effects. Column (3) includes magazine fixed effects. Column (6) uses instruments for *Website*.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

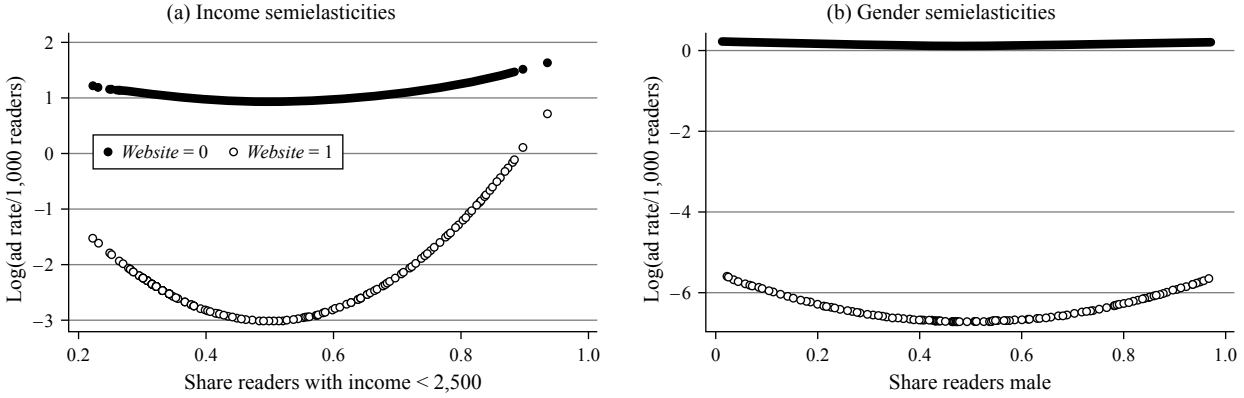
between the ages of 30 and 49, referred to as "prime-age" readers by advertisers. Not surprisingly, these readers are much more valuable to advertisers than are older and younger readers. In addition, readers under age 30 are more desirable than readers above 50, and the difference is statistically significant in all columns, again with the exception of column (3). Low-income readers have a clear negative effect on ad prices. There is some evidence that female readers are preferred by advertisers, although the gender premium is not always statistically significant. In fact, the results on *Gender* illustrate a key point of this paper: although neither gender commands an obvious price premium, *homogeneity* according to *Gender* has a clear positive effect on ad prices. Thus, the second moment of *Gender* is more important than the first, although this is not the case for the other demographic characteristics.

Is it possible that our results are driven by a secular increase in the premium that advertisers are willing to pay for targeted advertising, that is unrelated to the Internet but occurring at the same time? Note first that the regressions above contain a full set of period dummy variables, which should normally capture underlying trends. The results are almost completely unchanged if we instead include a time trend and dummy variables for calendar-quarters. As an additional test to check whether seasonality may be driving the results, we interact our three HHI variables with dummy variables for each quarter, leading to nine additional regressors. The coefficients on these interactions are both individually and jointly insignificant, whereas the coefficients on the variables of interest remain very similar to our previous results. We are therefore reassured that neither trends nor seasonal effects drive our results.

We illustrate the interaction of targeted advertising and *Website* in Figure 1, where we plot the predicted values of advertising rates per reader on the vertical axis against the demographics of magazine readers on the horizontal axis. These demographics are the share of low-income readers in panel (a) and the share of male readers in panel (b).[22] In each panel, the curve plotted with filled circles represents the

[22] We do not present the figure corresponding to the age of readers because we have three different reader age categories, which would require a three-dimensional figure to plot the semielasticities against the reader age shares. The general shape of these three-dimensional figures is, however, the same as in Figures 1 and 2.

Figure 1 The Effect of the Interaction of Gender and Income with Website on the Returns to Targeting



predicted values calculated by setting *Website* to zero for all observations, whereas the curve plotted with empty circles represents values setting it to 1. These figures were constructed using the coefficients in column (6) of Table 3, and the points that are plotted correspond to the observed data in our sample.

Both the shape and the relative heights of the curves in Figure 1 are informative. The first point to notice is that all four of the curves plotted are U-shaped, indicating that extreme values of the demographics are associated with higher advertising prices.[23] Thus, advertisers pay a premium for homogeneous audiences, which confirms the importance of targeted advertising. Similar U-shaped relationships were found by Chandra (2009) and Goettler (2012). The second point is that the shapes of the curves show that the value of targeted advertising is lower in the counterfactual case where no magazines have companion websites than in the case where they are all assumed to have websites, since the curve with filled circles is noticeably flatter than the one with empty circles in both panels. Thus, the advent of the Internet as measured by the presence of magazine websites has had the effect of heightening the premium paid for homogeneous audiences.

The third point to notice is the difference in the height of the curves. In both panels, the curve that corresponds to setting *Website* equal to 1 for all observations lies below the curve corresponding to *Website* equal to 0. This simply illustrates the large negative coefficient on the standalone *Website* coefficient in Table 3. In other words, magazines with websites generally have lower advertising prices than those without them, controlling for reader homogeneity.

Thus the figure conveys the three important findings from Table 3: first, regardless of whether magazines have websites, homogeneous audiences are more valuable than diverse audiences, confirming the importance of targeted advertising. Second, the effect of a companion website has generally been to lower advertising prices in the print edition, even adjusted for circulation. But third, the effect of launching Web editions has only heightened the importance of targeted advertising, by inflating the relative premium for homogeneous audiences. Another way to state this is that magazines that have a greater scope to target advertising are better able to withstand the adverse consequences of the Internet. This is because the difference between the vertical heights of the curves is smallest at extreme values of each demographic.

[23] Although not visually obvious at the current scale, the U-shape of the curve for *Website* = 0 in panel (b) is clear when the scale is adjusted.

4.2. Additional Results: The Share of Readers Using the Internet

We now turn to our second measure of the advent of the Internet: the share of readers at each magazine that regularly use the Internet. Table 4 presents the results of estimating Equation (2) using *ShareOnline* as the Internet variable.

Columns (1) and (2) of Table 4 show that *ShareOnline* is associated with a decrease in advertising rates. As before, the fit is better in Column (2), which includes category fixed effects, and an *F*-test again rejects the hypothesis that these are zero. We therefore maintain these fixed effects going forward. The base HHI coefficients remain positive and highly significant.

Column (3) of Table 4 interacts *ShareOnline* with the HHI measures. Two of the base HHIs remain positive, although *HHI Gender* is negative. Note, however, that these coefficients represent the premium for targeted advertising when *ShareOnline* is zero, which is the case in less than 0.5% of our observations. The interaction terms are all positive and highly significant, denoting a complementarity between targeted advertising and the Internet use of readers. The magnitude of the coefficients on these terms show that the premium for homogeneous audiences increases rapidly with the Internet use of readers. The *HHI Gender* effect turns positive at even moderately low values

Table 4 Targeted Advertising and the Share of Readers Online

	(1)	(2)	(3)	(4)
HHI Age	0.34***	0.52***	0.35***	0.56***
	(0.08)	(0.08)	(0.11)	(0.08)
HHI Income	0.75***	1.17***	0.54**	2.02***
	(0.16)	(0.18)	(0.21)	(0.25)
HHI Gender	0.24***	0.28***	−0.37***	0.22***
	(0.05)	(0.05)	(0.08)	(0.05)
ShareOnline	−0.43***	−0.40***	−3.24***	−3.24***
	(0.09)	(0.09)	(0.30)	(0.30)
HHI Age ∗ *ShareOnline*			0.51**	0.51**
			(0.21)	(0.21)
HHI Income ∗ *ShareOnline*			3.64***	3.64***
			(0.62)	(0.62)
HHI Gender ∗ *ShareOnline*			1.46***	1.46***
			(0.16)	(0.16)
Share Male	−0.32***	−0.00	−0.05	−0.05
	(0.03)	(0.03)	(0.03)	(0.03)
Share Age < 30	−0.63***	−0.44***	−0.47***	−0.47***
	(0.06)	(0.09)	(0.09)	(0.09)
Share Age > 50	−2.12***	−2.41***	−2.23***	−2.23***
	(0.07)	(0.08)	(0.09)	(0.09)
Share Income < 2,500	−2.76***	−2.59***	−2.60***	−2.60***
	(0.14)	(0.15)	(0.16)	(0.16)
Category fixed effects	No	Yes	Yes	Yes
N	6,002	6,002	6,002	6,002
R^2	0.49	0.51	0.52	0.52

Notes. The dependent variable is log(ad rate/1,000 readers). Robust standard errors are in parentheses. Regressions include quarter-year fixed effects. Column (4) demeans *ShareOnline*.

$^{**}p < 0.05$; $^{***}p < 0.01$.

of *ShareOnline*. To see this, we demean *ShareOnline* in column (4). Doing so implies that the coefficients on the base HHIs represent marginal effects at the mean of the distribution, and shows that these coefficients are all positive and highly significant.

Although we remind the reader of the caveat regarding causal interpretation using *ShareOnline*, the results of Table 4 provide further evidence of a complementarity between the advent of the Internet and the potential to target advertising. The Internet use of readers is associated with a decrease in advertising rates at the average magazine, as was the case with magazine websites. However, magazines with more homogeneous readers are again able to mitigate this effect.

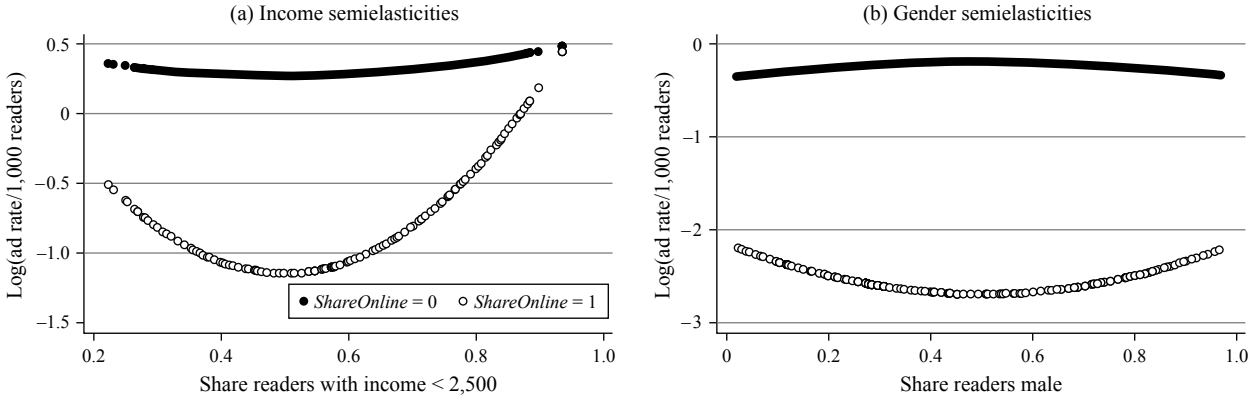
Figure 2 presents a graphical relationship between targeted advertising and *ShareOnline*. As was the case in Figure 1, the curve with filled circles is flatter than the curve with empty circles, in both panels. One of the curves in panel (b) actually has a concave shape, reflecting the unexpected negative coefficient on *HHI Gender* in column (3) of Table 4. As discussed above, though, this represents an unrealistic scenario even in the early years of our sample. Once again, the effects of targeting are more pronounced when all readers are online, compared with the case where none of them are.

4.3. Implications of the Results

We briefly clarify the implications of our results so far. The results do not imply that magazines have benefited from the advent of the Internet. As discussed earlier, a number of sources have shown that traditional media has lost large numbers of consumers to online competition, and this is true in our own data on the German magazine industry as well. Moreover, our results also show that, even controlling for audience sizes, advertising rates are lower at magazines with websites, and those with a larger number of readers online. Thus, print magazines appear to be worse off with the advent of the Internet, confirming general fears regarding this industry as discussed in §1. What our results do make clear is that reaching a homogeneous audience raises advertising rates at all magazines, and that this premium for targeted advertising has grown stronger with the growth of the Internet. In other words, offline and online channels appear to be complements with regard to targeted advertising.

What is the explanation for this phenomenon? At this stage we need to hypothesize, since it is

Figure 2 The Effect of the Interaction of Gender and Income with Internet Use on the Returns to Targeting



difficult to conclusively prove any single explanation. However, the common link between magazines with websites and those with a large number of Internet users is the likelihood that readers of such magazines consume content from multiple sources, and especially from online sources. Readers who regularly use the Internet are of course directly consuming online content from sources such as news sites, blogs, and online aggregators. As far as magazine websites are concerned, publishers usually launch these to retain readers that they fear may be lost to other online competition. Moreover, subscribers to a magazine's print edition are usually provided with free access to the online edition. To this point, Kaiser and Kongsted (2012) document a large content overlap between the print edition and the website for a set of magazines that is similar to our sample. We make the assumption that readers of a magazine with a website are more likely to visit that site to complement their print reading. Research in the newspaper industry indicates a large degree of overlap among readers of the print and online editions; the reasons include readers of the print edition wanting to stay ahead of breaking news, and wanting to complete reading or reread articles later in the day that they began in the morning.[24] Note, however, that we are not aware of similar studies being conducted for magazine readers; therefore our results on this matter should be interpreted with caution.

The type of readers we have just described are thus more likely to *multihome*, i.e., consume more than source for news and entertainment. However this also implies that these readers are more likely to be exposed to advertising on each different media source. Our hypothesis is that being exposed to advertising on different media may make these consumers especially valuable from the point of view of advertisers. To be clear, we are not claiming that advertisers can necessarily track users across different media, although in some cases they do. Rather, our view is that when advertisers know that consumers are multihomers, and thus exposed to advertising across a range of media, it raises their willingness to pay for these consumers at any given medium.

Advertising the same product in multiple media outlets is referred to as "cross-advertising" by media practitioners. Many publishers explicitly refer to cross-advertising possibilities in their magazine's fact sheets, which are aimed at potential advertisers. See, for example, the fact sheet for *Auto Zeitung* (2013), which is a popular automotive magazine in Germany. The fact sheet shows that the magazine celebrates the fact that its readers consume its print edition as well as its online edition through computers, tablets, and mobile devices. The fact sheet also invites advertisers to purchase cross-media advertising campaigns. Similar references to cross-advertising exist at other magazine fact sheets. See, for example, the fact sheet for *Brigitte* (2013), which is a very popular women's magazine. This fact sheet also discusses cross-media advertising campaigns.

Our explanation regarding cross-advertising may appear counterintuitive. It seems to violate the basic assumption of recent theoretical work that advertisers do not want their message to be transmitted multiple times to the same readers. For this reason, papers such as Bergemann and Bonatti (2011) and Athey et al. (2013) take as given that multiple advertising messages are redundant. However, this presumes a very particular model of advertising: one in which consumers only require a single exposure to an advertising message to increase their likelihood of purchasing the good, beyond which further exposures are wasted.

By contrast, if advertising requires repeated exposure to consumers to inform or persuade them about the good being marketed, then multiple messages may not be a waste for advertisers. Moreover, if viewing an advertiser's message in different forms—such as audio, video, and print—helps to reinforce the message to consumers, then there may well be complementarities from the good being advertised not just multiple times, but also across multiple media.

Prior research has shown that being exposed to the same brand or ad campaigns across multiple channels can indeed help consumers to retain information about characteristics of the advertised good. Naik and Raman (2003) and Naik and Peters (2009) are two examples of studies that find synergies in advertising the same good across print, radio, and television. As noted earlier, Zigmond and Stipp (2010) and Joo et al. (2014) also find complementarities in advertising across online and offline media. We argue that a similar phenomenon can explain our finding of complementarities between targeting in print magazines and the advent of the Internet.

To establish this hypothesis more conclusively, and to rule out alternative explanations, we require more evidence. It may well be the case, for example, that advertisers value Internet users more highly for some unobserved characteristic of theirs that we have been unable to control for, rather than for the specific fact that they multihome. Therefore, we try to identify groups of consumers in our data who are more likely to multihome in general, rather than only those who consume content online. Although we have no direct data on the propensity to consume multiple media, we can identify the magazine types that are most likely to be read by multihoming consumers.

Among the different magazine categories on which we have data, three in particular stand out as being

[24] See Scarborough Research (2007).

likely to be read by consumers who multihome across different media. These are television, computer, and business/finance magazines. TV magazines are publications that focus on detailed listings and reviews of shows on television. We believe it is reasonable to assume that those who subscribe to TV magazines consume more television than the average magazine reader. Similarly, computer magazine readers are disproportionately likely to own and use their computers to consume content online. Finally, subscribers of business and finance magazines are likely to be actively interested in information on investing and market news. The fast-paced nature of this information makes these consumers more likely to follow the business news on other channels such as television and the Internet.

In Table 5 we present results from estimating Equation (1) for these groups of magazines. If our hypothesis is correct, then homogeneous groups of these potential multihoming consumers should be particularly valuable to advertisers. Thus, we examine whether the premium for targeted advertising is greater at these three groups of magazines than for the overall sample.

The results in Table 5 show that the HHI measures generally have the expected positive sign. The effects are not statistically significant in the case of two coefficients, but this is likely to be due to the much smaller samples that constitute each of the three magazine groups as opposed to the overall sample. But more importantly, the magnitude of the coefficients in each of the three columns is considerably greater than in the results of Tables 3 and 4. This suggests that there is an even greater premium associated with homogeneous readers at these particular magazines. This constitutes corroborating evidence for our hypothesis that readers who consume multiple media are particularly valuable for targeted advertising.

Table 5 Potential Multihoming Readers

	(1)	(2)	(3)
	Business and finance	Computers	Television
HHI Age	2.49**	3.43***	0.53
	(0.97)	(0.74)	(0.58)
HHI Income	2.20***	12.77***	2.51***
	(0.44)	(3.15)	(0.48)
HHI Gender	1.13*	3.78	4.14***
	(0.65)	(2.40)	(1.26)
Share Male	0.96	−4.34**	2.44***
	(0.61)	(2.12)	(0.73)
Share Age < 30	1.92**	−0.60	0.24
	(0.76)	(0.64)	(0.74)
Share Age > 50	−0.05	2.26*	−0.65
	(0.41)	(1.28)	(0.56)
Share Income < 2,500	−1.21***	−8.46***	−0.72
	(0.26)	(1.03)	(0.57)
N	314	234	633
R^2	0.72	0.58	0.32

Notes. The dependent variable is log(ad rate/1,000 readers). Robust standard errors are in parentheses. Regressions include quarter-year fixed effects.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

5. Managerial Implications and Conclusion

In this paper we have established the importance of targeted advertising in magazine markets and showed how it has changed with the advent of the Internet. 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 attention to analyzing the intermediary role of the media, to empirically determining the value of targeted advertising, or to studying the effects of the Internet on the value of targeting in print media.

We first show that the potential for targeted advertising raises equilibrium advertising rates in the magazine industry, which confirms previous findings in other contexts. We then use data on the existence of magazine websites and on the extent of magazine readers' Internet use to examine how targeted advertising has changed with the advent of the Internet. Our results suggest a complementarity between the value that a magazine can generate from targeted advertising and both its decision to launch a website as well as the share of its readers that are online. These results are consistent with the notion that targeted advertising becomes more valuable when advertisers know that consumers multihome across different media, and can therefore be reached by advertisements in other forms as well.

This is an important finding, because it goes against the traditional assumption that advertisers prefer media consumers who do not multihome, because of the potential for wasted impressions in different media. We draw on existing research to argue that multiple exposures to the same message, especially across different media, may actually increase brand awareness and the likelihood of being persuaded to purchase the product. We provide supporting evidence to show that targeted advertising is more valuable when audiences are more likely to multihome in general, not just on the Internet. We do this by examining specific groups of magazines, whose readers we believe to be particularly likely to consume multiple media.

We emphasize again that our claim is not that traditional print media have been made better off by the arrival of the Internet. There is no doubt that print audiences—and correspondingly, ad revenues—have declined in recent years. We show that although both

measures of the advent of the Internet have been associated with a decrease in print advertising prices, they have also been associated with an increase in the premium that advertisers are willing to pay for homogeneous, as opposed to diverse, audiences. Therefore, magazines that provide a greater scope for targeted advertising have been able to mitigate the adverse consequences of the Internet.

Thus, our results suggest ways by which print media may try to withstand the advent of the Internet. They may explain why the magazine industry has done considerably better than newspapers in recent years. Our results also suggest that print media publishers possess the tools to weather the rise of the Internet, by striving toward delivering well-tailored audiences to their advertisers.

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Appendix. Equilibrium Advertising Rates as a Function of Demand and Supply Shifters

Let the representative advertiser's (inverse) demand for advertising at magazine k in time period t be given by

$$P_{kt} = f(Q_{kt}, \mathbf{X}_{kt}), \tag{3}$$

where P refers to the price of advertising, Q is the quantity (measured in terms of pages, or column inches), and $\mathbf{X}$ is a vector of magazine characteristics. The important characteristics contained in $\mathbf{X}$ are reader demographics in particular.

Magazines can either be viewed as operating in a competitive environment, or with some degree of market power. If magazines are competitive, then the supply of advertising at magazine k is given by

$$Q_{kt} = g(P_{kt}, \mathbf{Z}_{kt}), \tag{4}$$

where $\mathbf{Z}$ is a vector of magazine publishers costs. We can now derive the reduced form expression relating equilibrium prices to demand and supply shifters, by substituting (3) into (4) and eliminating Q:

$$P_{kt} = h(X_{kt}, Z_{kt}). \tag{5}$$

This reduced form equation shows how exogenous changes in the demand and supply shifters affect equilibrium prices. Note that the parameters in this equation are not structural parameters; that is, they do not tell us anything about the underlying demand and supply curves. Instead, they capture equilibrium effects of changes in $\mathbf{X}$ and $\mathbf{Z}$ on equilibrium prices.

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