Internet Use, Competition, and Geographical Rescoping in Yellow Pages Advertising

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Abstract

This paper examines the effect of Internet penetration on competition and prices in the market for Yellow Pages advertising. We find that the diffusion of the Internet is associated with a decrease in the number of competitors and average prices for printed advertisements in the long-run. However, the decrease in prices is moderated by increasing market concentration as firms exit and by geographic rescoping as remaining competitors repositioned their products.

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1 Introduction

Since the 1990s, the diffusion of the Internet reshaped the way consumers search for goods and services, as well as the markets for goods and services themselves. This led to significant interest in the effect of the Internet on offline markets, particularly those markets that are well-served by online sellers, such as books, CDs, and computers. Some examples are Brynjolfsson and Smith (2000), Goolsbee (2001), Ellison and Ellison (2006), Prince (2007), and Chandra and Kaiser (2014).[1] We examine how competition and prices evolve in the market for print Yellow Pages advertising as Internet usage rises over a fifteen-year period.

Yellow Pages advertising provides an ideal setting for studying the effects of Internet diffusion on competition and prices. First, the Internet provides a clear alternative to Yellow Pages' primary service—providing search and information. Second, detailed data on prices and locations allows us to study both market structure and prices. Because geographic scoping of directories is a publisher's most important product characteristic, we can also document how publishers repositioned their products in response to Internet competition. Third, Yellow Pages advertising consists of a large number of local geographic markets, which is amenable to statistical analysis.

Finally, studying this industry allows us to overcome challenges in identifying the supply-side influence of the Internet on offline competition. A key issue is that a decline in the number of firms may occur due to a supply-side or demand-side shock. For example, in prior studies that focus on the decline of offline retailers for leisure goods such as books or CDs, the diffusion of the Internet may lead to a decline in the number of offline book or music stores if consumers purchase books or CDs from an online retailer instead of an offline retailer (supply-side effect), or if consumers substitute their leisure time away from reading books and listening to CDs towards surfing the Internet (demand-side effect). The

[1] See Goldfarb and Tucker (2017) for an overview.

advantage of our study is that Yellow Pages advertising is not a leisure activity, so we can isolate the supply-side shock of the Internet on competition.

We empirically test the theoretical predictions of competition between online and traditional retail sectors (Alba et al., 1997; Bakos, 1997; Pan et al., 2002; Lal and Sarvary, 1999; Viswanathan, 2005; Chun and Kim, 2005). The growth of the Internet may decrease the number of competitors in offline markets; as low-cost online retailers enter, existing offline retailers may exit the market. The expansion of the Internet may have an ambiguous effect on prices. On one hand, prices may fall if the demand for traditional retailers falls as online retailers become an attractive alternative. On the other hand, prices may rise if market concentration increases as traditional retailers exit the market, or if remaining retailers reposition their products to maintain prices in the presence of Internet competition.

We also highlight the importance of product repositioning. Although repositioning is presumably an important general response to market shocks such as entry, it receives limited study that we are aware of. Some exceptions include choice of retail formats and circulation of newspapers (Ellickson et al., 2012; George and Waldfogel, 2006) as well as repositioning in the context of mergers between airlines, radio stations, and ice cream manufacturers (Li et al., 2018; Sweeting, 2010; Mazzeo et al., 2018). We are not aware of any studies on repositioning in the context of offline response to the Internet. Because one of the most important characteristics of a Yellow Pages directory is its geographic scope, we show that publishers appear to adjust geographic scope more intensively in markets with more Internet usage, and that doing so prevents some of the decrease in prices that we might otherwise observe.

We construct a unique dataset that covers printed directories by all publishers in the years 1999 and 2014, a period when the industry underwent massive changes. We combine data on prices from the Rate and Data publication of the Yellow Pages Publishers Association (YPPA, now known as the Local Search Association) with data on Internet usage and

demographics for the distribution areas. We test whether locales with relatively fast Internet growth also experienced relatively large changes in the Yellow Pages market, focusing on outcome variables such as the number of competitors and prices.

Our results illustrate how competition falls and market concentration rises. With the expansion of the Internet, the number of directories produced by smaller independent publishers decreases. Due to the overall decline in the number of firms, industry concentration rises by approximately 20%. Our results also indicate that the Internet has a direct effect of decreasing average prices of printed advertisements by providing a substitute to online advertisements, particularly for smaller print advertisements. However, remaining firms did not decrease prices as substantially as they otherwise would, since the exit of smaller independent firms led to a rise in market concentration.

Further, we study the repositioning of Yellow Pages directories. We provide several measures of geographic repositioning and show that markets with more repositioning have higher prices, and the negative effect of the Internet on prices is higher when controlling for repositioning. Thus, it appears that the Internet induced publishers to reposition their products, which prevented price declines to some extent.

Our paper has implications for how policymakers evaluate competition. In order to evaluate the level of competition between rivals, policymakers often focus on whether rivals affect prices. For example, merger authorities often assess whether firms compete in the same market by measuring whether the presence of one firm affects the prices of another.[2] Our results show that even if price effects are not evident, competition may manifest in other strategic variables. Similarly, the Federal Communication Commission is often called upon to regulate the competitive transition from one technology to another, and often relies on price effects to determine whether competition in one technology disciplines another.[3]

[2]A famous example occurs in the US Federal Trace Commission case against the merger of Office Depot and Staples, in which the FTC presented a regression of prices on the presence of Walmart and other office super-stores (Baker, 1999; Dalkir and Warren-Boulton, 2004).

[3]Examples of competing technologies under the FCC's jurisdiction are wired long distance service and

However, our results suggest that even when competition between technologies is important, price effects may appear small, and instead competition may more strongly affect other strategic variables.

Our paper relates to several strands of literature. It connects to prior work that analyzes how the rise of the Internet led to a decline in competition for leisure goods (Goldmanis et al., 2010; Forman et al., 2009). As mentioned previously, because Yellow Pages are a non-leisure good, we isolate the supply-side effect of the Internet. Our study also links to work that examines how Internet penetration affects price dispersion and competition (Orlov, 2011; Ater and Orlov, 2015), advertising (Seamans and Zhu, 2014; Goldfarb and Tucker, 2011; Chandra and Kaiser, 2014), and consumption of offline substitutes (Gentzkow, 2007; Liebowitz and Zentner, 2012). In addition, our paper relates more generally to research on the printed Yellow Pages market (Rysman, 2004; Busse and Rysman, 2005). Our paper contributes to the few studies that examine a firm's decision to reposition its products. We also provide an overview of the changes in competition, pricing, and product positioning in a market over a fifteen year period in response to a large and sustained competitive shock.

2 Industry Overview

Publishers distribute Yellow Pages directories, which are directories of local businesses. The directories typically provide listings for free and charge for items such as having a bold line and number, an advertisement of various sizes, or an advertisement with color. Traditionally, Yellow Pages were bundled with White Pages directories, which provided listings of residential telephone numbers. White Pages directories were required by telephone companies to be distributed to every phone line, but a number of states eliminated those regulations since 2010. Still, the most important Yellow Pages directories are associated with Regional Bell

microwave communication, circuit-switched and packet-switched telephony, and traditional cable television and video service via the Internet (so called "over-the-top video"). In a white paper for the FCC later cited in its rulemaking, Rysman (2016) uses price effects (to the exclusion of other strategic variables) to evaluate competition between business data services delivered by fiber and copper wires.

Operating Company (RBOC).

Regional Bell Operating Companies were created in 1984 from a consent decree by the Justice Department that split the telephone company AT&T into seven independent regional phone companies. Since then the number of RBOCs decreased through mergers from seven to three: Verizon, CenturyLink, and AT&T Inc. Because RBOC companies did not overlap, by definition, there is at most one RBOC publisher per household. Although many consumers obtain their wired phone service from their cable company, or forgo wired phone service altogether, RBOCs tend to have higher prices even in our 2014 data. RBOC publishers can compete with independent publishers, which are publishers not associated with any telephone service.

Directories compete in part by offering different information in their directories, such as government phone numbers, local maps, and seating maps of local stadiums. A primary method of competition and appealing to consumers is the geographic scoping of the directory—deciding which geography the directory will cover. Directories are almost always distributed to every household in their geography. The scope of the directory affects which businesses will be available in the directory, and thus must be chosen to appeal to local consumers. Many publishers distribute more than one directory to a given household, perhaps a small neighborhood directory and a super-regional directory. It is difficult to track a given directory over time not only because of entry and exit, but also because of the extent of rescoping over our 15 year period.

In recent years, print directories face competition from online directories. Top online directories primarily include search engines (such as Google and Yahoo!) and business listings (such as Yelp and TripAdvisor). Established publishers with print directories also introduce online directories (such as yellowpages.com or dexknows.com), though consumers use these sites to a lesser extent compared to other online alternatives (Abramyk, 2016).

Industry observers, some of whom are employed by Yellow Pages publishers, generate

some interesting statistics about the industry, which we summarize here. Printed Yellow Pages directories generated revenues of $14 billion in 2004.[4] In 2004, 80 percent of online shoppers indicated referring to the print Yellow Pages in the past thirty days.[5] According to the Local Search Association in 2017, 40% of Americans consult at least one print Yellow Pages once a year (Kadet, 2016). While the Internet currently may be the first destination for consumers that are searching for new product and services, the print Yellow Pages directory is the second or third destination in over 50% of cases (Lewis, 2011).

Most publishers produce directories yearly and distribute them for free to consumers. Consumers who are older, live in rural areas, or are "ready to spend on a service" tend to rely relatively more on printed Yellow Pages rather than online directories. This is not surprising, since consumers who are older may be more accustomed to using the printed Yellow Pages to locate a service, and consumers who live in rural areas may have "less reliable internet access" (Ginsberg, 2017). The top 50 most used Yellow Pages categories comprise mostly of "service-oriented businesses where consumers are likely making instantaneous buying decisions–everything from roofing and HVAC to pest control, pet grooming and child care," and only 20 percent of the top listings consisted of retail businesses like grocers, lumber yards and sporting goods stores (Morrison, 2010).

3 Data and Description

We first describe the construction of our data set and then provide some description of how the market for Yellow Pages evolved over our time period.

3.1 Data on Competition and Pricing

We construct a dataset from multiple sources that covers the advertising prices and characteristics of all directories for the years 1999 and 2014. Our pricing data derives from *Rate*

[4]Jane Dennison-Bauer, *From Phone Books to MySpace: Assessing the Complete YP Universe,* Knowledge Networks, Fall/Winter 2014.

[5]Source: Knowledge Networks/SRI, YPA Industry Usage Study 2004.

and Data publication of the Yellow Pages Publishers Association (YPPA). We collect data on directories from 1999 and 2014 using a procedure similar to Busse and Rysman (2005). We observe advertising prices for five categories of advertisement sizes (i.e., quarter column, double quarter column, double half column, half page, and full page).[6] We also collect data on the distribution areas for each directory, so we observe the zipcodes that each directory serves.

We obtain data on Internet usage from the Consumer Population Survey (CPS) Internet Usage Supplement 2000 and 2012, which report the geographic location and Internet usage for individuals. Our variables of interest include the Core-based Statistical Area (CBSA) or Metropolitan Statistical Area (MSA) where each individual resides and a dummy variable indicating whether the person connects to the Internet from home.[7] We calculate the percentage of people who use the Internet in each of the reported geographic units. Since our directory data reports coverage of each directory by zipcode, we match zipcodes to the corresponding CBSA or MSA to recover Internet usage in the area.[8]

We supplement with additional demographic and local market data. We obtain demographic information from the 2000 Census and the 2010 Census and American Community Survey (ACS).[9] For each zipcode, we collect data on the total population, whether it resides in an urban area, percentage of college graduates, percentage of high school graduates, median household income, percentage of owner-occupied housing, percentage that lived in

[6] A single page is divided into four columns and four rows, generating 16 equal sized pieces. A quarter column consists of 1/16 of a page.

[7] The CPS in 2000 reports data for MSA, and in 2012 the CPS switches reporting to CBSA.

[8] Note that some zipcodes are not categorized under a CBSA, so we do not have Internet usage for these zipcodes; for instance, several rural zipcodes and universities with their own zipcode do not have an assigned CBSA. If a zipcode is covered by more than one CBSA, we identify the "main" CBSA, the one that covers the largest population of the zipcode. Ideally, we would like to observe Internet data at the zipcode-level. However, no reliable data exists at this level of geography; the National Broadband Map and Fixed Broadband Deployment Data Form 477 from the Federal Communications Commission (FCC) do not provide adequate information.

[9] Since 2010, the ACS replaced the long-form decennial census data. The 2010 Census only has short-form data on basic questions such as age, sex, and race.

same house for 5 years, percentage that moved from a different county, percentage that moved from a different state, percentage that uses public transportation, and density of the population.[10] We obtain the number of business establishments for each zipcode from the 2000 and 2010 County Business Patterns.

To capture characteristics for each local market, we construct two final datasets for competition and pricing at the 3-digit zipcode-level. We focus our analysis at the 3-digit zipcode area for several reasons. The geographic area of the 3-digit zipcode captures common shocks to demand and supply at the local market. As we compare changes over a fifteen year period, boundaries of 3-digit zipcode are more likely to remain similar compared to smaller geographic units such as 5-digit zipcodes. Furthermore, a broader definition of the geographic market such as a CBSA would include areas too large with directories that do not compete with each other.

Our competition dataset contains variables on competition and demographics within each 3-digit zipcode. We measure the total number of publishers and directories in each 3-digit zipcode. We calculate the population-weighted averages of the demographic variables for each 3-digit zipcode.[11] Table 1 reports the summary statistics. The dataset consists of 1326 observations or 3-digit zipcodes. The markets vary in the degree of competition and often consist of several publishers and directories. The average number of directories per 3-digit zipcode is 12, and the average number of publishers is approximately four.

Our pricing dataset measures prices for each local market.[12] We compute average prices of RBOC directories for each 3-digit zipcode by advertisement size, since advertisements vary in size. Each page is partitioned into 16 equally-size parts (created from four columns

[10]The education variables are measured as the highest level of educational attainment. For instance, percentage of high school graduates is the percentage who graduate from high school and do not have a higher degree; this excludes individuals who have some high school but do not graduate and individuals who graduate from college.

[11]For each 5-digit zipcode, we compute the weight as the fraction of population from the 3-digit zipcode.

[12]As we will discuss in the analysis section, we examine the prices charged by RBOCs during our time period because these publishers are more likely to remain in the market.

Table 1: Descriptive statistics for competition

	Mean	Std Dev	Min	Max
Internet	0.50	0.25	0	0.92
Publishers	3.77	2.10	1	12
RBOC publishers	1.11	0.55	0	4
Non-RBOC publishers	2.65	2.14	0	11
Directories	11.8	8.19	1	53
directories	5.68	4.97	0	39
Non-RBOC directories	6.10	6.58	0	48
total population	400401.8	375868.8	6756	2906701
urban population	0.73	0.24	0.11	1.00
% college graduates	0.16	0.056	0.043	0.38
% high school graduates	0.31	0.073	0.045	0.51
median household income	48888.8	14342.0	21923.5	118417.1
% owner-occupied housing	0.68	0.11	0.13	0.89
% living in same house	0.70	0.16	0.14	0.94
% moved from different county	0.13	0.089	0.0092	0.78
% moved from different state	0.065	0.058	0.0040	0.63
% using public transportation	0.035	0.075	0	0.69
density	2531.0	6177.7	1.51	124739.6
business establishments	555.6	270.2	21.6	2375.8
Observations	1326			

Notes: Observations are at the 3-digit zipcode-level.

Table 2: Descriptive statistics for prices

	Mean	Std Dev	Min	Max
Quarter column	1683.7	993.8	264	7094.4
Double quarter column	3342.3	1857.2	540	13394.4
Double half column	6304.9	3496.1	1080	26322
Half page	12298.3	6989.9	1238	45129.0
Full page	23646.3	14081.8	2040	103484.4
Total	9479.2	10959.9	264	103484.4
Observations	5660			

Notes: Observations are at the level of 3-digit zipcodes and advertisement size.

and four rows). From the smallest to the largest advertisement size, the sizes 1, 2, 4, 8, and 16 correspond to quarter column, double quarter column, double half column, half page, and full page. Table 2 summarizes the descriptive statistics of the key variables. Note that average prices vary substantially across the different advertisement sizes. The average price for an advertisement is approximately $9,479.

3.2 Changes in Competition and Pricing over 15 Years

This section provides general summary statistics on the industry over the past fifteen years. Table 3 compares the statistics on competition and prices for a quarter-column print advertisement between the years 1999 and 2014. We compute the statistics at the 5-digit and 3-digit level zipcode, and the measures are weighted by population.

We observe that over the fifteen year period, a decline in the number of publishers and directories occurred. Approximately one publisher and two directories exited each 3-digit zipcode area. As a direct consequence of exit by firms, average market share increased. As shown in Figure 1, the average HHI across publishers within each 3-digit zipcodes between 1999 and 2014 increased by 20%. Note that while the number of directories declined at the 3-digit zipcode area, the decline in directories within the smaller 5-digit zipcode area was relatively small.

During the same period, the average price for a quarter-column ad increased from $3018

to $4321. This represents an increase of 43%, compared to a CPI increase of 42% over this time, so in real terms, overall average price did not fall and only modestly increased.

Table 3: Average number of firms falls while prices rise between 1999 and 2014

	Mean	Std Dev	Min	Max
Year 1999				
Publishers in 5-digit zipcode	2.04	1.01	1	6
Directories in 5-digit zipcode	2.75	1.56	1	9
Publishers in 3-digit zipcode	4.64	2.34	1	12
Directories in 3-digit zipcode	15.78	10.99	1	53
Average quarter-column price	3018	1732	540	8748
Year 2014				
Publishers in 5-digit zipcode	1.60	.85	1	6
Directories in 5-digit zipcode	2.50	1.29	1	10
Publishers in 3-digit zipcode	3.03	1.64	1	8
Directories in 3-digit zipcode	13.12	8.57	1	40
Average quarter-column price	4321	2406	900	13394

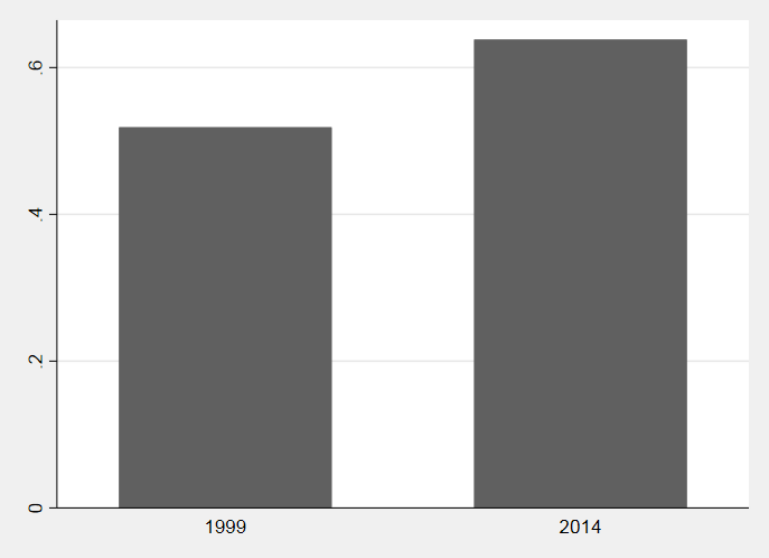
These statistics present a preliminary analysis. In the next section, we introduce a formal regression model to control for changes in demographics over this period and to test for statistically significant differences.

4 Market Structure and Pricing

This section provides a formal analysis of how market structure evolves with increasing Internet penetration and how prices change for the remaining competitors in the market.

4.1 Exit and Consolidation

Figure 1: Average HHI increases from 1999 to 2014



Note: This figure shows the HHI calculated over publishers population coverage within each 3-digit zipcode, averaged over zipcodes, in 1999 and 2014.

To estimate how rising Internet usage affects competition in the market, we estimate the expected number of competitors for each 3-digit zipcode z in year t:

$$E(comp_{zt}) = \exp(\beta_0 + \beta_1 Internet_{zt} + X_{zt}\gamma + \alpha_z + \delta_t) \quad (1)$$

where X is a matrix of demographic variables at the 3-digit zipcode level. The coefficients α and δ are 3-digit zipcode and year fixed effects. Since the dependent variable is a count variable, we estimate this equation as a Poisson regression using maximum likelihood. We cluster our standard errors at the CBSA-level to capture correlations at the regional level.[13]

To interpret the coefficients of the Poisson regression, the coefficient β_1 captures the proportional change in the number of competitors for every one percentage point increase in $Internet$:

[13]Each 3-digit zipcode is assigned to the main CBSA that encompasses the largest portion of their population.

$$\frac{\exp(\beta_0 + \beta_1(Internet_{zt} + 0.01) + X_{zt}\gamma + \alpha_z + \delta_t)}{\exp(\beta_0 + \beta_1 Internet_{zt} + X_{zt}\gamma + \alpha_z + \delta_t)} = \exp(0.01 * \beta_1) \tag{2}$$

If β_1 is less than zero, then a rise in $Internet$ is associated with a decline in the number of firms in the market. If β_1 is greater than zero, then a rise in $Internet$ is associated with an increase in the number of firms. If β_1 is equal to zero, then a rise in $Internet$ is associated with no change in the number of firms.

Table 4 reports the results of estimating equation (1) for all publishers and for each type of publisher. We find that the decline in competition is likely to be driven by exit by non-RBOCs (smaller independent) publishers. In Column (3), the estimated coefficient for the non-RBOC publishers is statistically significant and has a larger magnitude compared to the estimated coefficient for RBOC publishers in Column (2) which is statistically insignificant and has a smaller magnitude. For every one percentage point increase in Internet usage, the number of non-RBOCs publishers falls by 0.3%.[14]

In Column (4), we observe that with increasing Internet usage, the number of directories decreases. For every one percentage point increase in Internet usage, the number of overall and non-RBOC directories falls by 0.2% and 0.5%. Overall, we find that non-RBOCs exit and that RBOCs consolidate in response to Internet penetration.

4.2 Prices

The results from the previous section reveal that smaller non-RBOCs publishers exit the market as Internet usage increases. In this section, we examine how pricing may change for the remaining RBOC publishers in each market.

For each ad size, we compute the average price across RBOC directories within each 3-digit zipcode. Then we estimate the logarithm of the average price for an advertisement

[14]Because $\exp(0.01 * -0.332) = 0.997$, the number of publishers is 99.7% of previous levels or 0.3% lower.

Table 4: Directories exit markets or consolidate with higher Internet usage

	Publishers			Directories		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	RBOCs	Non-RBOCs	All	RBOCs	Non-RBOCs
Internet	-0.117	-0.0961	-0.332***	-0.227***	-0.357*	-0.473***
	(0.0789)	(0.148)	(0.124)	(0.0788)	(0.201)	(0.164)
Log population	-0.0733	-0.0389	-0.00665	0.240***	0.112	0.301
	(0.0856)	(0.157)	(0.168)	(0.0768)	(0.181)	(0.215)
urban population	0.892**	0.370	2.411***	1.489***	1.113	3.427***
	(0.433)	(0.978)	(0.794)	(0.364)	(0.959)	(1.012)
% college graduates	1.431	1.679	1.772	-2.346*	0.536	-8.223***
	(1.292)	(2.191)	(2.355)	(1.198)	(2.740)	(2.999)
% high school graduates	4.046***	-3.124**	6.919***	2.676***	-6.115***	6.346***
	(0.886)	(1.564)	(1.555)	(0.747)	(1.913)	(1.934)
Log household income	-0.235	-4.654***	0.795*	-0.122	-6.345***	3.612***
	(0.240)	(0.436)	(0.413)	(0.195)	(0.586)	(0.522)
% owner-occupied housing	2.681***	0.735	4.509***	-1.071	1.199	-2.110
	(0.791)	(1.244)	(1.355)	(0.713)	(1.547)	(1.737)
% living in same house	-2.546***	4.928***	-6.549***	-1.517***	5.633***	-10.45***
	(0.425)	(0.719)	(0.803)	(0.406)	(0.821)	(1.057)
% moved from different county	0.683	-0.182	-0.606	-0.882**	0.149	-4.249***
	(0.453)	(0.947)	(0.837)	(0.425)	(1.093)	(1.161)
% moved from different state	-0.344	5.529***	0.154	0.988**	5.513***	1.032
	(0.519)	(0.956)	(0.968)	(0.461)	(1.240)	(1.312)
% using public transportation	-1.068	-4.736**	3.438	0.128	-3.824	6.307*
	(1.607)	(2.279)	(3.457)	(2.007)	(2.615)	(3.575)
Log density	0.169**	-0.124	0.310***	-0.0376	-0.251*	0.163
	(0.0668)	(0.118)	(0.115)	(0.0653)	(0.129)	(0.147)
Log business establishments	0.0888	-0.413**	0.144	-0.211**	-0.897***	0.146
	(0.0952)	(0.197)	(0.167)	(0.0992)	(0.245)	(0.231)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Zipcode Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1326	1326	1326	1326	1326	1326

Notes: Robust standard errors. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

of type i in 3-digit zipcode z in year t:

$$\begin{aligned} \ln(price)_{izt} &= \alpha_0 + \alpha_1 Internet_{zt} + \alpha_2 directories_{zt} \\ &\quad + \beta ln(size_i) + X_{zt}\gamma + \delta_z + \rho_t + \epsilon_{izt} \end{aligned} \tag{3}$$

where *Internet* measures the fraction of Internet users, and *directories* is the number of RBOC directories. The variable *size* denotes the fraction of the page covered by the advertisements, and the matrix X contains the demographic variables for each 3-digit zipcode. The coefficients δ and ρ are fixed effects by 3-digit zipcode and year. We cluster our standard errors at the CBSA-level to account for regional correlations in pricing.[15]

Table 5 reports the results of our regression. The negative coefficient of Internet indicates that Internet usage has a direct effect of decreasing prices in the market. The estimates in Column (2) imply that for every 1 percentage point increase in Internet users, average price in the market declines by 0.24%.

Our results indicate that the decrease in prices from the Internet is slightly offset by increasing consolidation. When we include the number of RBOC directories as a measure of consolidation in Columns (2)-(4), the effect of the Internet is more negative. Note that the number of RBOC directories captures consolidation at the 3-digit zipcode because competition rarely exists between RBOC publishers; the vast majority of 5-digit zipcodes (96% in our sample) are served by at most one RBOC publisher.[16] The effect of the number of RBOC directories on price captures economies of scale or efficiency from consolidation.

[15]Each 3-digit zipcode is assigned to the main CBSA that encompasses the largest portion of their population.

[16]The coefficient on # of RBOC directories is interpreted as 3-digit consolidation. 99.9% of 5-digit zipcodes in 1999 are served by at most one RBOC publisher. In 2014, 92% of 5-digit zipcodes are served by at most RBOC publisher, and the others are served by 2 RBOC publishers.

Table 5: Prices fall due to increase Internet usage

	(1)	(2)	(3)	(4)
Internet	-0.208*	-0.243**	-0.341***	-0.379***
	(0.106)	(0.103)	(0.109)	(0.109)
Internet × Log size				0.0975***
				(0.0218)
Internet × Size 2			0.0250	
			(0.0361)	
Internet × Size 4			0.00210	
			(0.0340)	
Internet × Size 8			0.225***	
			(0.0637)	
Internet × Size 16			0.244***	
			(0.0584)	
directories		-0.0102*	-0.0104*	-0.0103*
		(0.00571)	(0.00572)	(0.00571)
Log population	0.223	0.258	0.255	0.256
	(0.164)	(0.164)	(0.165)	(0.165)
Urban population	-0.442	-0.347	-0.352	-0.350
	(0.500)	(0.486)	(0.486)	(0.486)
% college graduates	-2.280	-2.054	-2.048	-2.066
	(1.676)	(1.668)	(1.665)	(1.664)
% high school graduates	-1.151	-1.093	-1.088	-1.101
	(0.990)	(0.998)	(0.995)	(0.995)
Log income	-0.398	-0.491	-0.487	-0.487
	(0.313)	(0.305)	(0.306)	(0.306)
% owner-occupied housing	1.244	0.997	1.028	1.012
	(0.780)	(0.767)	(0.776)	(0.773)
% living in same house	-1.824***	-1.603***	-1.621***	-1.607***
	(0.596)	(0.567)	(0.570)	(0.569)
% moved from different county	-0.804	-0.965	-0.980	-0.971
	(0.677)	(0.680)	(0.678)	(0.679)
% moved from different state	-0.0478	0.277	0.291	0.291
	(0.709)	(0.709)	(0.710)	(0.709)
% using public transportation	0.254	0.235	0.269	0.261
	(1.273)	(1.249)	(1.251)	(1.247)
Log density	-0.0592	-0.0679	-0.0667	-0.0672
	(0.0670)	(0.0668)	(0.0668)	(0.0668)
Log business establishments	0.0323	0.0161	0.0167	0.0159
	(0.173)	(0.169)	(0.170)	(0.169)
Log size	0.942***	0.942***		0.893***
	(0.00821)	(0.00820)		(0.0121)
Year Fixed Effects	Yes	Yes	Yes	Yes
Zipcode Fixed Effects	Yes	Yes	Yes	Yes
Observations	5647	5647	5647	5647
R-Squared	0.965	0.965	0.966	0.965

Notes: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Robust standard errors reported. The dependent variable is the logarithm of average price in a 3-digit zipcode. Our sample consists of prices for RBOCs for all ad sizes.

In Columns (3) and (4), we include interactions of the Internet on the advertisement size to allow the competitive effect of the Internet to vary by the type of advertisement. We expect online advertisements to be closer substitutes to smaller print ads rather than prominent full-page print ads. The positive and statistically significant coefficients on the interactions of Internet with larger ads (sizes 8 and 16) support our hypothesis that average prices did not drop as much for larger ads compared to smaller ads. In other words, we find that the reduction in prices from online competition occurs for smaller size print ads.

5 Rescoping as a Response to Competitive Shocks

5.1 Rescoping to Maintain Prices

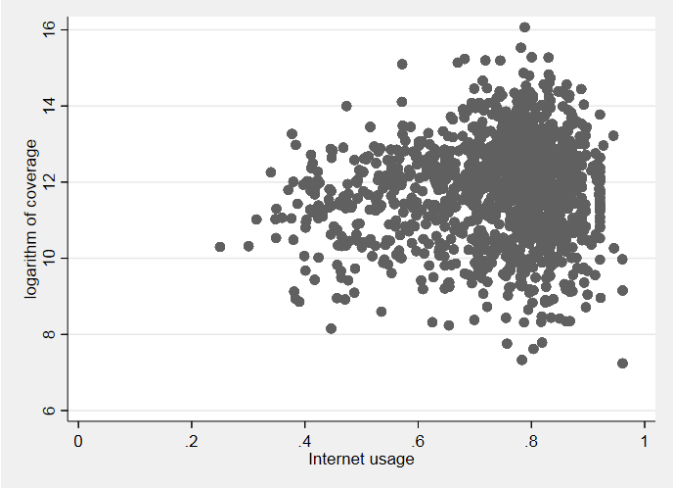
We observe from our results in the prior section that Internet usage leads to a decline in prices for remaining RBOC publishers. In this section, we explore whether remaining RBOC publishers adapted to increased Internet usage also through product rescoping.

Firms may rescope their products to maintain prices in response to increased competition. We define rescoping as a firm changing its product characteristics.[17] For a publisher, a key product characteristic of its directories is the distribution area. With increasing Internet usage and competition from online directories, publishers may change the distribution area of their directories to reach different consumers. We define a directory's "coverage" as the population covered or served by a directory. Rescoping may involve narrowing or broadening the distribution area; the directories may be more narrowly targeted or have more breath of coverage.

A preliminary test for rescoping checks for whether the number of consumers in the distribution area changes as Internet usage increases. If rescoping occurs in response to increased competition from the Internet, we would expect changes in the number of covered

[17]Rescoping may also include retargeting. Both concepts describe a firm changing its product to reach different consumers.

Figure 2: Dispersion of coverage increases with Internet usage in 2014



Note: This figure plots the logarithm of coverage (the population covered by a directory) by Internet usage in 2014.

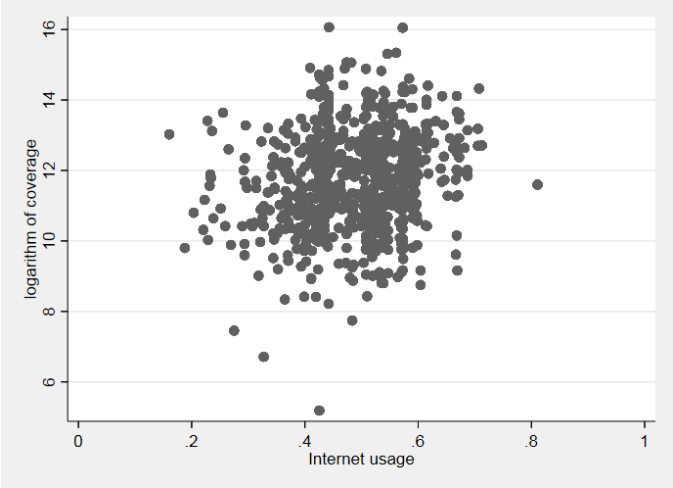
consumers in areas with higher Internet usage. We graph the logarithm of each directory's population against Internet penetration.[18] Figure 2 shows that dispersion in a directory's population increases with Internet usage in 2014.

As a robustness check, Figure 3 graphs the logarithm of each directory's population against Internet penetration in 1999 before the widespread use of Internet. Because Internet penetration is lower in 1999, areas exhibit a smaller range of Internet penetration compared to 2014. Directories also have a lower variance of population coverage. It appears that the widespread adoption of Internet by 2014 led to a competitive shock that introduced significant variation in coverage among directories.

We view the increased variation in a directory's population associated with high Internet penetration in 2014 as evidence that publishers engaged in rescoping in response to Internet penetration. A story consistent with our findings is that before the Internet, it was optimal either for publishers to choose distribution areas of "average size," or for publishers to not

[18] As discussed previously, we focus on RBOCs publishers, since these publishers remained in the market while small non-RBOCs exited during our period.

Figure 3: Dispersion of coverage and Internet usage in 1999



Note: This figure plots the logarithm of coverage (the population covered by a directory) by Internet usage in 1999.

adjust their scope very often due perhaps to a fixed cost involved in determining the optimal geographic scope. Then once the rise of the Internet threatened revenue, it became worthwhile for publishers to rescope their directories in order to become more targeted towards various consumer preferences. This led some directories to become larger and some to become smaller.

Under these ideas, areas with more rescoping should see relatively higher prices, and the negative effect of the Internet should be larger when controlling for rescoping. To explore this hypothesis, we create a measure of rescoping for each (3-digit) zipcode. The idea is to identify areas that underwent significant rescoping as measured by increased variation in coverage by directories between 1999 and 2014.

We compute the standard deviation of the population among all directories within a given 3-digit zipcode. For instance, if a zipcode is covered by one small directory and one large one, the standard deviation will be large. If a directory is covered by two equally sized directories, the standard deviation will be small. Then we divide the standard deviation by the mean

of the population of directories to obtain the coefficient of variation, which normalizes the measure, because some 3-digit zipcodes will be large and encompass larger populations while others may be smaller. To identify areas with increased variation in population coverage, we calculate the change in the coefficient of variation between 1999 and 2014.

Formally, let $\mathcal{D}_{zt}$ be the set of directories in 3-digit zipcode z in period t, indexed $i = 1, \ldots, n_{zt}$. Let c_{izt} be the number of people covered by directory i in zipcode z at time t and $\bar{c}_{zt}$ be the mean across directories, so $\bar{c}_{zt} = \sum_{i \in \mathcal{D}_{zt}} c_{izt}/n_{zt}$. We define the *coverage coefficient of variation* in zipcode z at time t to be:

$$\text{cv}_{z,t} = \sqrt{\frac{\sum_{i \in \mathcal{D}_{zt}} (c_{izt} - \bar{c}_{zt})^2}{n_{zt} - 1}} \frac{1}{\bar{c}_{zt}}.$$

We define rescoping to be:

$$\lambda_z = \text{cv}_{z,2014} - \text{cv}_{z,1999}.$$

Large positive values indicate that the variation in distribution areas increased over time, and rescoping occurred. In our regressions, we treat λ_z both as a continuous variable and as a discrete variable by categorizing the 3-digit zipcodes into four quartiles of low to high rescoping.

Our measure is meant to capture the form of repositioning that we believe is most important in our application. For instance, a publisher that adjusts two evenly-sized directories to have one large and one small one will lead to a large rescoping value. However, our measure is imperfect. A publisher that adjusts the two directories in a way that they continue to be evenly-sized will not affect the value, and adding a directory to the market that is the same size as the existing ones likewise will not affect the value. If these occur, our measure will tend to underestimate the amount of rescoping actually occurring. In this sense, our estimates provide a lower bound on the effect of rescoping on prices.[19]

[19] One challenge in devising a measure is that we cannot match directories or publishers over time, so we

In our robustness checks, we compute a different measure based on HHI which does capture changes in the number of directories, and we also implement a statistic that captures changes outside of the base 3-digit zipcode. However, in general, it is difficult to design a single statistic that captures all forms of rescoping. Repositioning in our setting is complex, at least relative to a number of other studies. For instance, repositioning in Li et al. (2018) is a binary choice of whether to offer direct or indirect air service between two cities. As a result of the greater variety in strategic choices in our setting, we propose a measure that emphasizes the most relevant form of repositioning.

As a first step, we test whether areas with increased Internet penetration also have higher rescoping. In Table 6, we regress the rescoping measure λ_z against changes in Internet usage, number of RBOC directories, and demographics for all 3-digit zipcodes.[20] Column (1) reports the results when the change in Internet usage is linearly included in the regression, and Column (2) reports the results when change in Internet usage is categorized into four quartiles. The results indicate that areas with increases in Internet usage also experience more rescoping.

are unable to track exactly how each particular directory shifts coverage over time.

[20]If a 3-digit zipcode only had one directory, then we do not compute the coefficient of variation or HHI for that 3-digit zipcode because the standard deviation is not meaningful.

Table 6: Rescoping increases with Internet usage

	(1)	(2)
Δ Internet	0.218*	
	(0.131)	
Δ Internet Quartile 2		-0.0241
		(0.0578)
Δ Internet Quartile 3		0.146***
		(0.0553)
Δ Internet Quartile 4		0.102*
		(0.0538)
Observations	375	375
R-Squared	0.101	0.128

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Robust standard errors reported. The dependent variable is the amount of rescoping in a 3-digit zipcode. The regressions control for changes in demographics and the number of RBOC directories.

Next, we explore the relationship between pricing and rescoping by estimating the change in the logarithm of average prices for advertisement type i in 3-digit zipcode z as:

$$\begin{aligned} \Delta \ln(price)_{iz} &= \alpha_0 + \alpha_1 \Delta Internet_z + \sum_{k=2}^{4} \alpha_k RescopingQuartile_{kz} \\ &\quad + \alpha_5 \Delta directories_{zt} + \beta ln(size_i) + X_z\gamma + \epsilon_{iz} \end{aligned} \tag{4}$$

where the Δ refers to the change in the relevant variables between the years 1999 and 2014. The variable $RescopingQuartile_k$ is a dummy variable that equals one if the 3-digit zipcode's level of rescoping λ_z was in quartile k, and $Internet$ is the Internet usage. The variable $size$ denotes the fraction of the page covered by the advertisements, and the matrix X contains the change in the number of RBOC directories and demographic variables between 1999 and 2014. Note that we control for the change in the number of RBOC directories in each zipcode to ensure that our measure of rescoping reflects geographic rescoping and not the entry and exit of directories.

If rescoping occurs, then we would expect a positive coefficient for higher quartiles of

Table 7: Rescoping leads to higher prices

	(1)	(2)	(3)	(4)	(5)	(6)
Δ Internet	-0.263***	-0.283***	-0.283***	-0.274***	-0.257**	
	(0.0976)	(0.0982)	(0.100)	(0.0949)	(0.101)	
Rescoping			0.0954***			0.0373***
			(0.0359)			(0.0126)
Extended Rescoping					0.0598***	
					(0.0204)	
Rescoping Quartile 2		0.0288		-0.0155		
		(0.0361)		(0.0394)		
Rescoping Quartile 3		0.00533		0.0796**		
		(0.0309)		(0.0377)		
Rescoping Quartile 4		0.0860**		0.106**		
		(0.0373)		(0.0474)		
Observations	1770	1770	1770	1770	1770	1770
R-Squared	0.111	0.122	0.122	0.128	0.128	0.162

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Robust standard errors reported. The dependent variable is the change in the logarithm of average price in a 3-digit zipcode. Our sample consists of prices for RBOCs for all ad sizes. The regressions control for changes in demographics and the logarithm of ad size.

rescoping. Areas where publishers reposition their products more extensively will experience a smaller decline in prices.

Table 7 reports the results of our regression. As seen in the table, the negative coefficient on $\Delta Internet$ indicates that as Internet usage increases in an area, average prices fall. This is expected and consistent with our results in the prior section that establishes the negative correlation between print prices and online competition. In Column (2), the positive coefficient on the dummy variable for $RescopingQuartile_4$ indicates that areas with increased variation in directory coverage had a smaller decrease in average prices. In these markets, publishers maintained their prices by rescoping their distribution areas.

Given that some publishers rescope their markets, the effect of the Internet may be even larger than previously measured. In fact, comparing the point estimates of the coefficient of $Internet$ across Columns (1) and (2) shows that once we control for rescoping, the Internet has a larger measured effect on prices, though the difference is not measured with accuracy.

In Column (3) of Table 7, we present a specification in which we drop the indicator variables for the four levels of rescoping, and instead include our rescoping measure λ_z as a linear variable. We find a similar qualitative result; the positive coefficient on *Rescoping* indicates that directories with increased variation in directory coverage, and thus more rescoping, had a smaller decrease in average prices.

5.2 Robustness Checks

We conduct additional robustness checks in this section. First, we re-compute our rescoping measures using the Herfindahl-Hirschman Index (HHI), instead of the coefficient of variation, across the population of directories within a given 3-digit zipcode. Because directories overlap, we compute the total population as the sum of all population covered by all directories so that the HHI will be between 0 and 1. That is, for directory i in zipcode z during year t, we define $\text{HHI}_z = \sum_{i \in \mathcal{D}_{zt}} s_{izt}^2$ where $s_{izt} = c_{izt} / \sum_{i \in \mathcal{D}_{zt}} c_{izt}$. We categorize each 3-digit zipcode into four quartiles of high to low rescoping. Column (4) of Table 7 reports the results. The results are qualitatively similar with high quartiles (areas of high rescoping) experiencing a smaller decline in prices.

Second, our measure of rescoping uses information from within a given 3-digit zipcode, but many directories cover areas that fall over multiple zipcodes. Coverage over these extended areas may be an important element of rescoping. We compute an alternative measure of rescoping by adjusting our previous measure to take into account overlapping distribution areas across 3-digit zipcodes. For each 5-digit zipcode, we identify all directories that serve that zipcode. Then we take the union of all 5-digit zipcodes covered by these directories, including those beyond the 3-digit zipcode. We compute the coefficient of variation across the directories' populations. Thus, conditional on the number of directories in an area, this measure increases as the publishers use directories to cover differently sized areas.

Formally, we define c_{it} as the total number of consumers covered by directory i in year t,

which may contain consumers within or outside of zipcode z. We also define $\bar{c}'_{zt}$ as the mean of coverage over directories in period t that cover 3-digit zipcode z. That is, $\bar{c}'_{zt} = \sum_{i \in \mathcal{D}_{zt}} c_{it}/n_{zt}$. Then, our measure of *extended coverage coefficient of variation* for 3-digit zipcode z in t is:

$$\text{cv}^e_{z,t} = \sqrt{\frac{\sum_{i \in \mathcal{D}_{zt}} (c_{it} - \bar{c}'_{zt})^2}{n_{zt} - 1}} \frac{1}{\bar{c}'_{zt}}.$$

We compute our measure of *extended coverage rescoping* for 3-digit zipcodes as:

$$\lambda^e_z = \text{cv}^e_{z,2014} - \text{cv}^e_{z,1999}.$$

In our preferred specification, we replace λ_z in our previous regression with a simple average of λ_z and λ^e_z, normalized so they have the same scale. That is, let $\bar{\lambda}$ and $\bar{\lambda}^e$ be the mean of λ_z and λ^e_z across 3-digit zipcodes, and let σ and σ^e be the standard deviations. We use the combined measure of rescoping:

$$\lambda'_z = \frac{1}{2} \frac{\lambda_z - \bar{\lambda}}{\sigma} + \frac{1}{2} \frac{\lambda^e_z - \bar{\lambda}^e}{\sigma^e}.$$

Thus, our new measure adjusts our prior measure to also account for changes that occur outside of the 3-digit zipcode. Column (5) of Table 7 replicates our regression using this new measure. The results are qualitatively similar. When we include both the prior rescoping measure (λ_z) and the extended calculation (λ^e_z) separately in the regression for Column (6), the estimated coefficients continue to be statistically significant.

5.3 Examples of Geographical Rescoping

Our results indicate that the rise of the Internet leads to an exit of smaller firms in the industry, and the remaining firms reposition their products in order to maintain prices in the wake of competition from the Internet. In this section, we consider two examples of how a

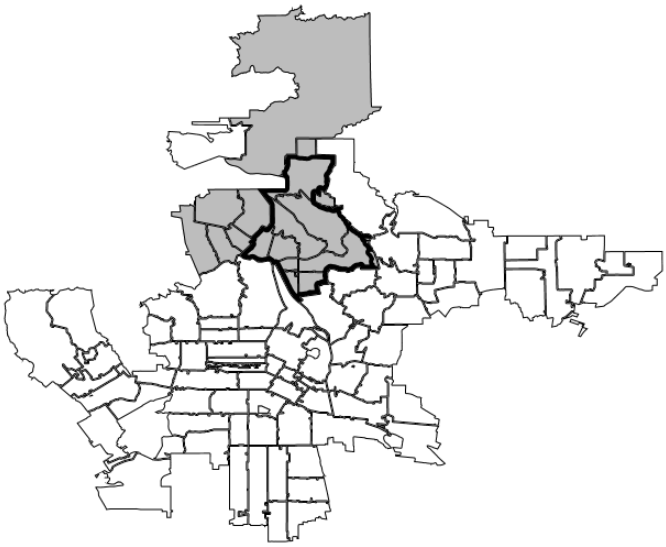
publisher may reposition its directories over time. We compare the coverage of directories by a RBOC publisher between 1999 and 2014. We identify two geographic areas that exhibited high rescoping.

Our first example is the 3-digit zipcode 912, which encompasses southern California. This area experienced large increases in Internet usage and rescoping. From 1999 to 2014, Internet usage increased by 35 percentage points from 0.44 to 0.79, and the coefficient of variation of directories' populations increased from 0.16 to 0.75.

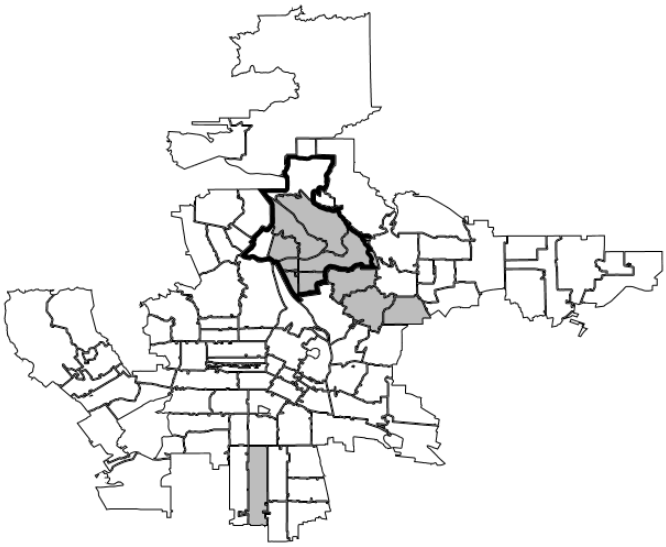
Figures 4 and 5 map the areas covered by the directories of the RBOC publisher YP between 1999 and 2014. The outline in bold marks the boundaries of the 3-digit zipcode for 912, and the figure also maps adjacent areas as well. In 1999, the two largest directories covered a large geography while a third directory covered a slightly smaller geography. By 2014, the publisher has significantly rescoped its directories by changing the coverage of two directories to smaller and more targeted regions and even introduced a fourth directory that was more narrowly targeted.

For our second example, the 3-digit zipcode 071 encompasses Newark, New Jersey. This area experienced large increases in Internet usage and rescoping. From 1999 to 2014, Internet usage increased by 30 percentage points from 0.53 to 0.83, and the coefficient of variation of directories' populations increased from 0.11 to 1.26.

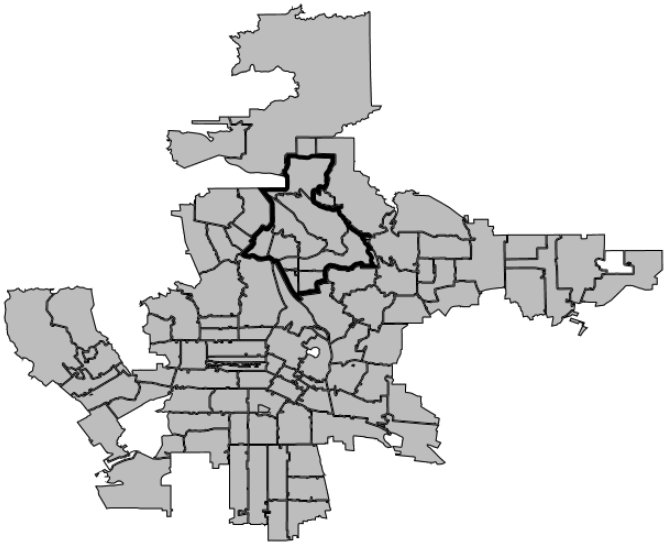
Figures 6 and 7 map the areas covered by each directory of the RBOC publisher YP between 1999 and 2014. The outline in bold marks the boundaries of the 3-digit zipcode for 071, and the graph also maps adjacent areas as well. In 1999, all three directories covered much of the same region and nearly the entire 3-digit zipcode. By 2014, the publisher rescoped the directories, so that each directory covered a different region of the zipcode. The first directory covers the northernmost region while the second directory extends to the western region beyond the 3-digit zipcode. The third directory covers the central and southern parts of the 3-digit zipcode.



(a)

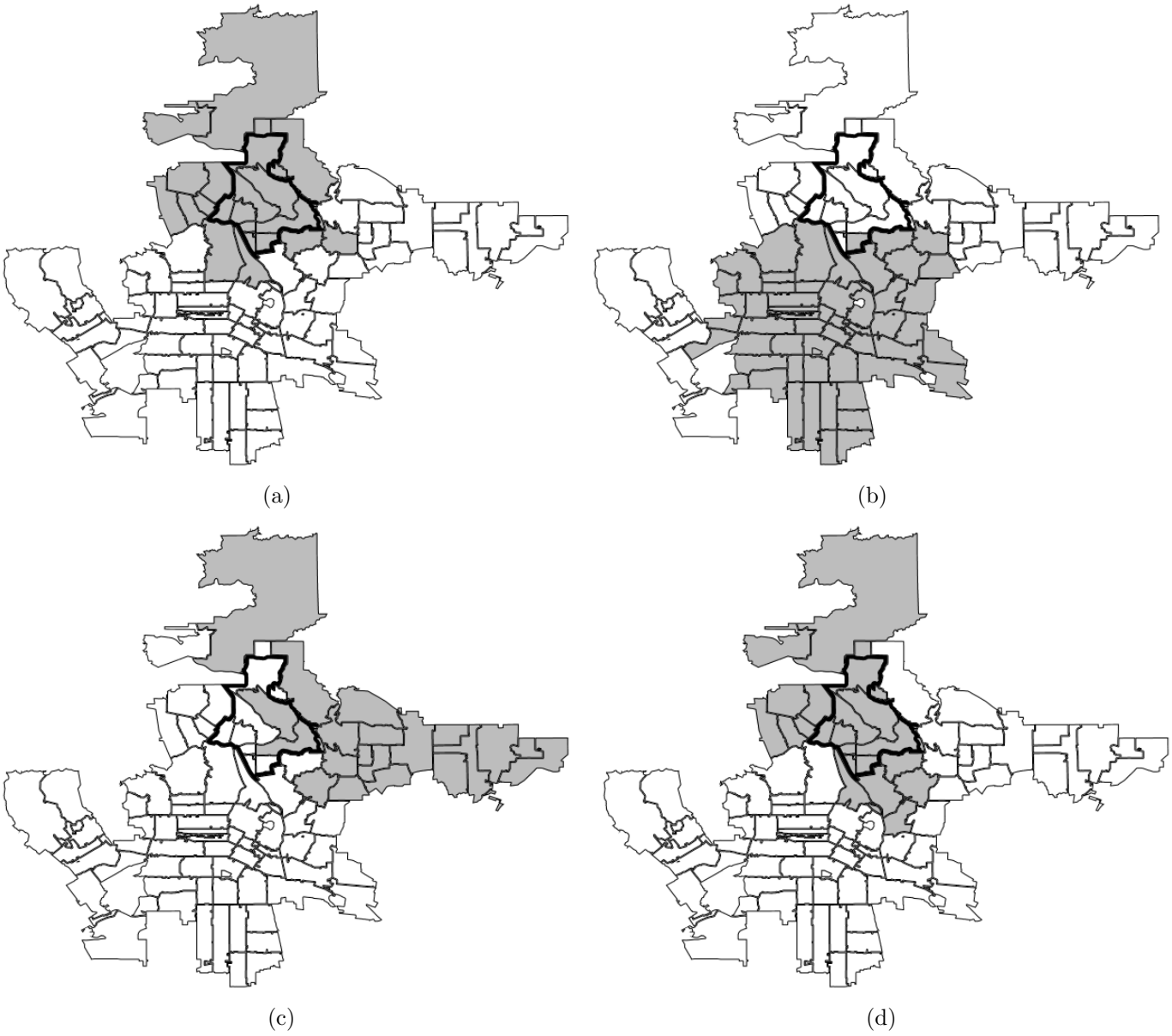


(b)



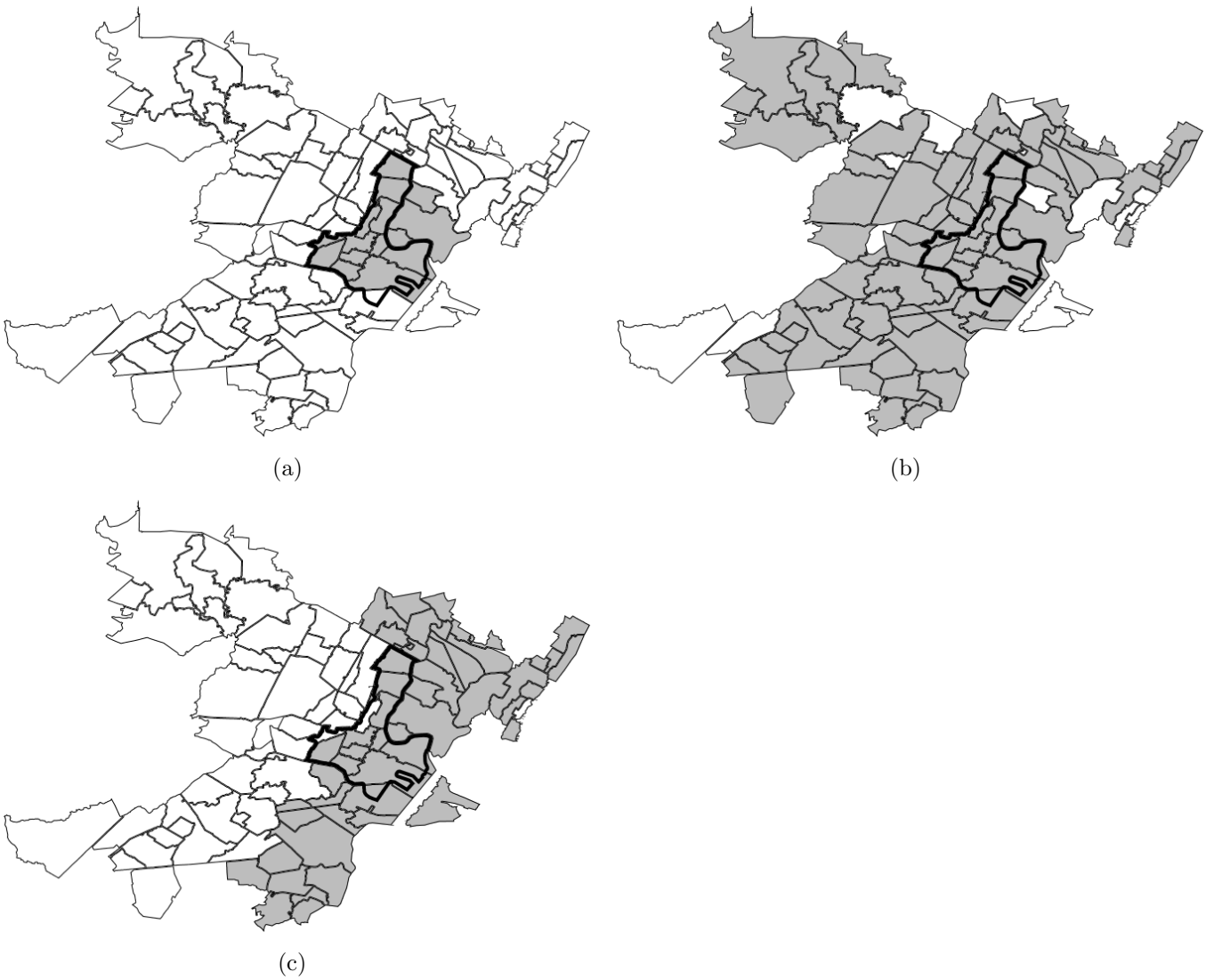
(c)

Figure 4: Coverage of directories of RBOC publisher in 3-digit zipcode 912 in 1999



(a) (b) (c) (d)

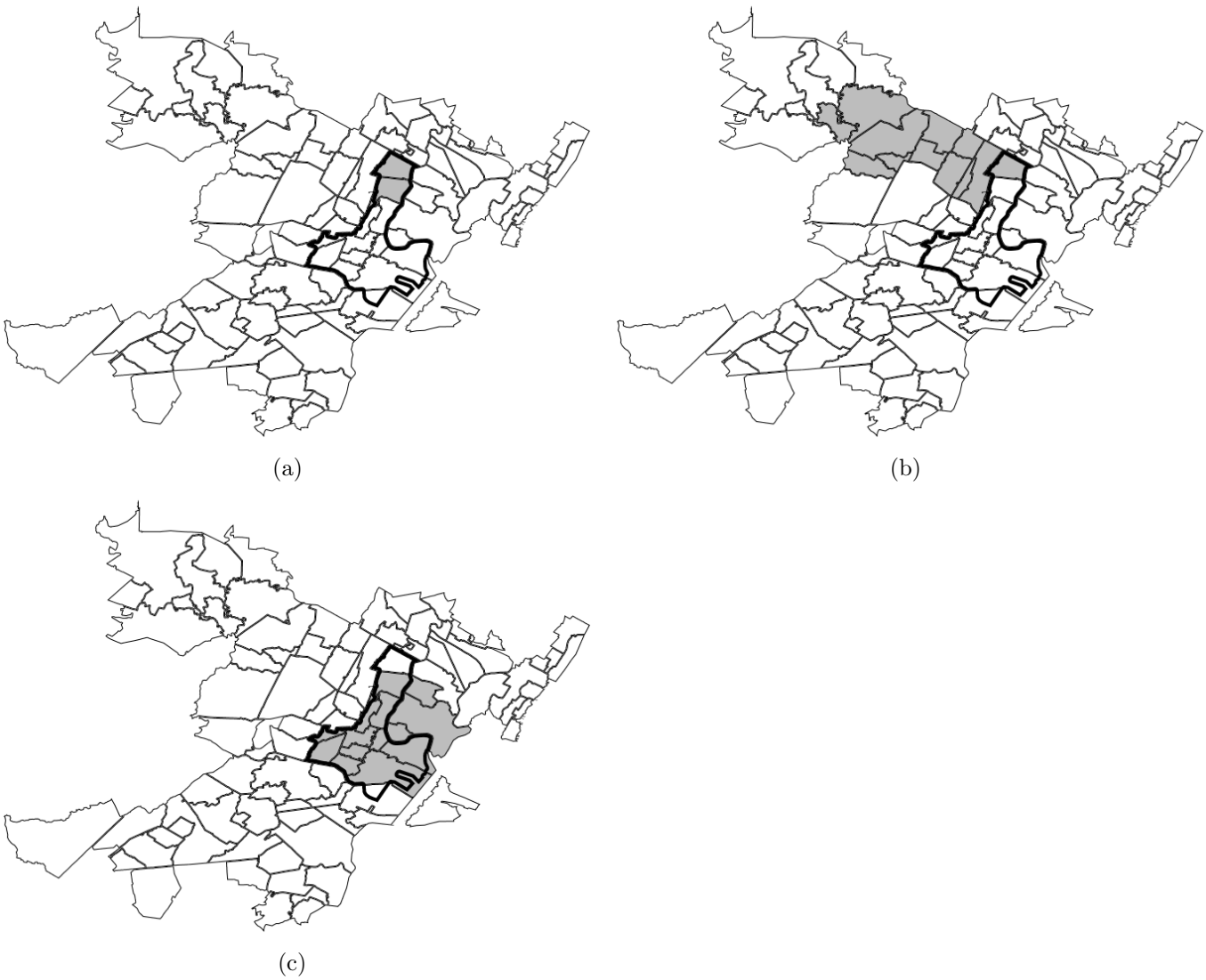
Figure 5: Coverage of directories of RBOC publisher in 3-digit zipcode 912 in 2014



(a) (b)

(c)

Figure 6: Coverage of directories of RBOC publisher in 3-digit zipcode 71 in 1999



(a)

(b)

(c)

Figure 7: Coverage of directories of RBOC publisher in 3-digit zipcode 71 in 2014

Our two examples reveal several patterns. First, the coverage of directories overlap significantly in 1999. This is consistent with our story that prior to the rise of online directories, offline directories chose distribution areas of "average size" or did not adjust scope very often due perhaps to a fixed cost involved in determining the optimal geographic scope. Second, by 2014, the publishers chose distribution areas of varying sizes, presumably to better target its customers.

Rescoping potentially enables the publisher to more closely target a specific consumer preference. By redefining the scope of their coverage, the directory had an opportunity to maintain its prices even in the wake of increasing Internet usage. Overall, this rescoping raised demand for the directories at the same time the Internet reduced demand.

6 Conclusion

This paper examines the effect of Internet usage on competition and prices in the market for Yellow Pages advertisements. We find that online competition led smaller firms to exit the industry. Average prices fell, but by less than expected as exit by firms led to increased consolidation.

We also provide evidence of how firms may respond to competitive pressure from the online sector by repositioning and changing the scope of their products to maintain prices. Publishers can rescope their products by broadening or narrowing the coverage areas of their directories in order to more closely target their customers. We find that publishers appear to adjust geographic scope more intensively in markets with more Internet usage, and that doing so prevents some of the decrease in prices that we might otherwise observe.

Our paper analyzes the broad competitive responses of an industry that underwent massive changes over a 15-year period. We find that with increasing competitive pressures from online competitors, existing firms respond both by exit, pricing, and product repositioning.

References

Abramyk, H. (2016, May). The Top 100 Online Business Directories. *Vendasta Blog*.

Alba, J., J. Lynch, B. Weitz, C. Janiszewski, R. Lutz, A. Sawyer, and S. Wood (1997). Interactive home shopping: Consumer, retailer, and manufacturer incentives to participate in electronic marketplaces. *The Journal of Marketing 61*, 38–53.

Ater, I. and E. Orlov (2015). The effect of the internet on performance and quality: Evidence from the airline industry. *Review of Economics and Statistics 97*(1), 180–194.

Baker, J. B. (1999). Econometric analysis in FTC v. Staples. *Journal of Public Policy & Marketing 18*, 11–21.

Bakos, J. Y. (1997). Reducing buyer search costs: Implications for electronic marketplaces. *Management Science 43*, 1676–1692.

Brynjolfsson, E. and M. D. Smith (2000). Frictionless commerce? a comparison of internet and conventional retailers. *Management Science 46*, 563–585.

Busse, M. and M. Rysman (2005). Competition and price discrimination in Yellow Pages advertising. *RAND Journal of Economics 36*, 378–390.

Chandra, A. and U. Kaiser (2014, July). Targeted advertising in magazine markets and the advent of the internet. *Management Science 60*, 1829–1843.

Chun, S. H. and J. Kim (2005). Pricing strategies in B2C electronic commerce: Analytical and empirical approaches. *Decision Support Systems 40*, 375–388.

Dalkir, S. and F. Warren-Boulton (2004). Prices, market definition, and the effects of merger: Staples-Office Depot. In J. E. Kwoka and L. J. White (Eds.), *The Antitrust Revolution: Economics, Competition, and Policy* (4 ed.)., pp. 52–72. Oxford University Press.

Ellickson, P., S. Misra, and H. Nair (2012, December). Repositioning dynamics and pricing strategy. *Journal of Marketing Research 49*, 750–772.

Ellison, G. and S. F. Ellison (2006). Internet Retail Demand: Taxes, Geography and Online-offline Competition. Working Paper 12242, NBER Working Paper Series.

Forman, C., A. Ghose, and A. Goldfarb (2009). Competition between local and electronic markets: How the benefit of buying online depends on where you live. *Management Science 55*, 47–57.

Gentzkow, M. (2007, June). Valuing new goods in a model with complementarity: Online newspapers. *The American Economic Review 97*, 713–744.

George, L. and J. Waldfogel (2006, March). The New York Times and the Market for Local Newspapers. *American Economic Review 96*, 435–447.

Ginsberg, M. (2017). Should You Advertise in the Yellow Pages in 2017? *Contractor Marketing*.

Goldfarb, A. and C. Tucker (2011, April). Advertising bans and the substitutability of online and offline advertising. *Journal of Marketing Research 48*, 207–227.

Goldfarb, A. and C. Tucker (2017). Digital economics. Technical Report, National Bureau of Economic Research.

Goldmanis, M., A. Hortacsu, C. Syverson, and O. Emre (2010). E-commerce and the market structure of retail industries. *Economic Journal 120*, 651–682.

Goolsbee, A. (2001). Competition in the computer industry: Online versus retail. *The Journal of Industrial Economics 49*, 487–499.

Kadet, A. (2016). Yellow Pages Hang On in Digital Age. *Wall Street Journal*.

Lal, R. and M. Sarvary (1999). When and how is the internet likely to decrease price competition? *Marketing Science 18*, 485–503.

Lewis, K. (2011). Should Small Businesses Still Book Yellow Page Ads. *Forbes*.

Li, S., J. Mazur, Y. Park, J. Roberts, A. Sweeting, and J. Zhang (2018). Repositioning and market power after airline mergers. Unpublished Manuscript, University of Maryland.

Liebowitz, S. and A. Zentner (2012, February). Clash of the titans: Does internet use reduce television viewing? *The Review of Economics and Statistics 94*, 234–245.

Mazzeo, M., K. Seim, and M. Varela (2018). The Welfare Consequences of Mergers with Endogenous Product Choice. *Journal of Industrial Economics*.

Morrison, H. (2010). Not Your Father's Phone Book. *Entrepreneur*.

Orlov, E. (2011). How Does the Internet Influence Price Dispersion? Evidence from the Airline Industry. *Journal of Industrial Economics 59*(1), 21–37.

Pan, X., B. Ratchford, and V. Shankar (2002). Price competition between pure play versus bricks-and-clicks e-retailers: Analytical model and empirical analysis. *The Economics of the Internet and E-Commerce 11*, 29–62.

Prince, J. T. (2007). The beginning of online/retail competition and its origins: An application to personal computers. *International Journal of Industrial Organization 25*, 139–156.

Rysman, M. (2004). Competition between networks: A study of the market for Yellow Pages. *The Review of Economic Studies 71*, 483–512.

Rysman, M. (2016). Empirics of business data services. Appendix B of *Business Data Services Federal Notice of Proposed Rulemaking*, FCC 16-54.

Seamans, R. and F. Zhu (2014, February). Responses to entry in multi-sided markets: The impact of Craigslist on local newspapers. *Management Science 60*, 476–493.

Sweeting, A. (2010). The effects of mergers on product positioning: Evidence from the music radio industry. *Rand Journal of Economics 41*, 372–397.

Viswanathan, S. (2005). Competing across technology-differentiated channels: The impact of network externalities and switching costs. *Management Science 51*, 483–496.