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

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Abstract

This paper examines the e ect of Internet penetration on competition and prices in the market for Yellow Pages advertising. We nd that the di usion 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 attenuated by increasing market concentration as rms exit and by geographic rescoping as remaining rms repositioned their products.

1 Introduction

Since the 1990s, the di usion 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 signi cant interest in the e ect of the Internet on o ine 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 fteen-year period.

Yellow Pages advertising provides an ideal setting for studying the e ects of Internet di usion 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.

of the Internet on residual demand for a retailer.

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 o ine markets; as low-cost online retailers enter, existing o ine retailers may exit the market. The expansion of the Internet may have an ambiguous e ect 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, particularly inelastic consumers remain in 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 o ine response to the Internet. Because one of the most important characteristics of a Yellow Pages directory is its geographic scope, we show that

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

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 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 de nition, 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 Yellow Pages 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 o ering di erent 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 a ects 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 di cult 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 rst 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). However, Kadet (2016) reports signi cant declines in the industry, especially in recent years.

Most publishers produce directories yearly and distribute them for free to consumers. Prices are thus for a year of advertising. Although directory publishers often also provide online directories, listing there is typically a separate price. Consumers who are older, live in rural areas, or are \ready to spend on a service" tend to rely rinrin8y\r8y9mrs

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. We deliberately examined a wide berth of years because we want to capture long-term trends in the industry. Our pricing data derive from Rate and Data publication of the Yellow Pages Publishers Association (YPPA).[6] 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).[7] We also collect data on the distribution areas for each directory, so we observe the zipcodes that

to the corresponding CBSA or MSA to recover Internet usage in the area.[10]

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).[11] 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 same house for 5 years, percentage that moved from a di erent county, percentage that moved from a di erent state, percentage that uses public transportation, and density of the population.[12] 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 nal 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 fteen year period, boundaries of 3-digit zipcodes are more likely to remain similar compared to smaller geographic units such as 5-digit zipcodes. Furthermore, a broader de nition 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

[10] 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.

[11] 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.

[12] 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.

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
RBOC 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

Table 2: Descriptive statistics for prices

	Mean	Std Dev	Min	Max
Quarter column	1673.3	968.7	264	7090.5
Double quarter column	3322.5	1809.4	540	13375.8
Double half column	6268.1	3401.4	1080	26268
Half page	12284.4	6980.0	1238	45129.0
Full page	23490.3	13693.3	2040	103275.3
Total	9430.8	10806.8	264	103275.3
Observations	5647			

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

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 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 di erent advertisement sizes. The average price for an advertisement is approximately $9,430.

3.2 Changes in Competition and Pricing over 15 Years

This section provides general summary statistics on the industry over the past fteen years. Table 3 compares the statistics on competition and prices for a double 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.

relatively small.

During the same period, the average price for a double 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 rms 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 double 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

$$\frac{\exp(\ _0 + \ _1(\text{Internet}_{zt} + 0{:}01) + X_{zt}\ \beta + \ _z + \ _t)}{\exp(\ _0 + \ _1\text{Internet}_{zt} + X_{zt}\ \beta + \ _z + \ _t)} = \exp(0{:}01 \quad _1) \qquad (2)$$

If $_1$ is less than zero, then a rise in Internet is associated with a decline in the number of rms in the market. If $_1$ is greater than zero, then a rise in Internet is associated with an increase in the number of rms. If $_1$ is equal to zero, then a rise in Internet is associated with no change in the number of rms.

Table 4 reports the results of estimating equation (1) for all publishers and for each type of publisher. We nd that the decline in competition is likely to be driven by exit by non-RBOCs (smaller independent) publishers. In Column (3), the estimated coe cient for the non-RBOC publishers is statistically signi cant and has a larger magnitude compared to the estimated coe cient for RBOC publishers in Column (2) which is statistically insigni cant and has a smaller magnitude. For every one percentage point increase in Internet usage, the number of non-RBOCs publishers falls by 0.3%.[17]

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 nd that non-RBOCs exit and that RBOCs decrease the number of directories 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. Note that we focus on pricing of RBOCs because our empirical results indicate that RBOC publishers are more likely to remain in the market. Also, in general, RBOC publishers have substantially higher market share. This raises the question of why and how do RBOC publishers respond to the competitiqers68-s

Table 4: Directories exit markets 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 di erent 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 di erent state	-0.344	5.529	0.154	0.988	5.513	

of Internet competition.

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

$$\ln(\text{price})_{izt} = \beta_0 + \beta_1 \text{Internet}_{zt} + \beta_2 \text{directories}_{zt} + \ln(\text{size}_i) + X_{zt}\gamma + \alpha_z + \alpha_t + \varepsilon_{izt} \quad (3)$$

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 β and γ 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.[18]

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. In other words, prices would have decreased more without 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.[19] The effect of the number of RBOC directories

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

[19] The coefficient on 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

on price captures economies of scale or e ciency from consolidation.

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)

In Columns (3) and (4), we include interactions of the Internet on the advertisement size to allow the competitive e ect 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. Smaller text ads are similar to online search ads because online search ads typically have a text limit of 3 lines (Google, 2019). The physical attributes of the smaller text ads and online search ads are also similar (e.g., amount of text, number of lines). By contrast, larger full page ads di er substantially in appearance from online search ads because of the use of images, colors, and increased number of text and lines. While some online display ads share features of color images, the size of online display ads are unlikely to dominate the full screen of the computer in the way that a full page ad dominates the entire page of the Yellow Pages. Moreover, online search ads are also a more appropriate comparison to Yellow Pages ads because these search ads are shown as a direct response to a consumer's query for a service in the same way that consumers turn to the Yellow Pages when they are searching for something particular.

The positive and statistically signi cant coe cients 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 nd that the reduction in prices from online competition occurs for smaller size print ads.

5 Rescoping as a Response to Competitive Shocks

5.1 How and why do rms rescope?

We de ne rescoping as a rm changing its product characteristics.[20] For a publisher, a key product characteristic of its directories is the distribution area. We de ne a directory's \coverage" as the population covered or served by a directory. Rescoping may involve narrowing

[20] Rescoping may also include retargeting. Both concepts describe a rm changing its product to reach di erent consumers.

or broadening the distribution area; the directories may be more narrowly targeted or have more breadth of coverage.

As residential and commercial geography changes, or the patterns of where consumers shop changes, rescoping directories becomes more valuable. For instance, if a new highway passes through a neighborhood, consumers in that neighborhood may be willing to consider stores and services from farther way, and might be interested in a directory with a wider scope. If a neighborhood develops a new commercial center, consumers in that neighborhood may prefer a more narrowly scoped directory.

One reason as to why rms rescope is that under an increase in Internet penetration, some consumers may switch away from using the Yellow Pages to online directories, leaving the publisher with a selected set of consumers. These consumers may be older, or less interested in technology, and may have di erent driving and shopping patterns. Publishers may nd it valuable to rescope as their consumer base changes, allowing the rm to maintain prices in response to increased competition.

That is, prior to the growth of the Internet, it was optimal either for publishers to choose distribution areas of \average size," or for publishers to not adjust their scope very often due perhaps to a xed cost involved in determining the optimal geographic scope. Then once the rise of the Internet threatened revenue and changed consumer habits, 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 e ect of the Internet should be larger when controlling for rescoping. To explore this hypothesis in the following section, we create a measure of rescoping for each (3-digit) zipcode. The idea is to identify areas that underwent signi cant rescoping as measured by increased variation in coverage by directories between 1999 and 2014.

5.2 Testing for Rescoping

We observe from our prior results in Section 4.2 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.

As a preliminary test for rescoping, we check 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 consumers in areas with higher Internet usage. We graph the logarithm of each directory's population against Internet penetration.[21] Figure 2 shows that dispersion in a directory's population increases with Internet usage in 2014. 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.

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. Note that this gure examines the same relationship as in Figure 2 but for an earlier time period of 1999 instead of 2014. We would expect to observe less variation both in Internet usage and coverage compared to Figure 3 because this is a period prior to widespread usage of Internet. As expected, we observe that areas exhibit a smaller range of Internet penetration compared to 2014. Directories also have a lower variance of population coverage. A comparison of the two gures suggests that the widespread adoption of Internet by 2014 led to a competitive shock that introduced signi cant variation in coverage among directories.

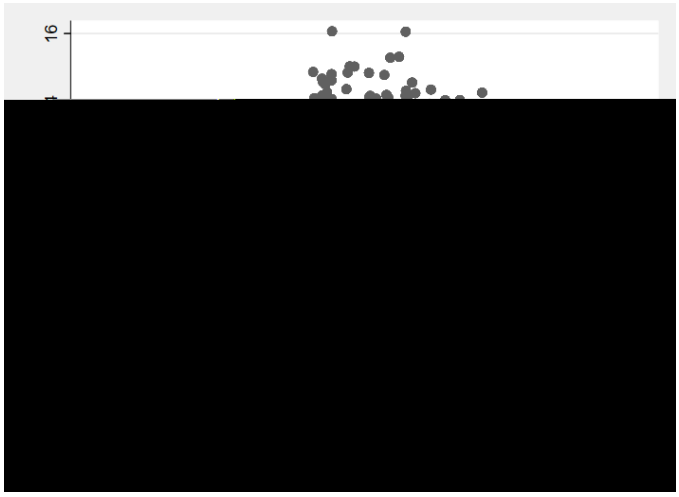
To more formally test for rescoping, we now develop a measure of rescoping. We compute the standard deviation of the population among all directories within a given 3-digit zipcode. For instance, if a zipcode is covered by one small directory and one large one, the standard

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

Figure 2: Dispersion of coverage and Internet usage in 2014

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

Figure 3: Dispersion of coverage and Internet usage in 1999



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

deviation will be large. If a directory is covered by two equally sized directories, the standard

separately control for the number of directories in a market.

In our robustness checks, we compute a di erent 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 di cult 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 o er 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.

We explore our analyses using changes over time because we want to compare areas with high versus low Internet growth and rescoping. As a rst step, we test whether areas with increased Internet penetration also have higher rescoping. If rms respond to increased competition from the Internet by rescoping, then expect Internet penetration and our measure of rescoping to be positively correlated. In Table 6, we regre8 Td nm-

Table 6: Rescoping increases with Internet usage

	(1)	(2)
Internet	0.218	
	(0.131)	
Internet Quartile 2		-0.0241
		(0.0578)
Internet Quartile 3		0.146
		(0.0553)
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:

$$\ln(\text{price})_{iz} = \beta_0 + \beta_1 \text{Internet}_z + \sum_{k=2}^{4} \gamma_k \text{RescopingQuartile}_{kz} + \beta_5 \text{directories}_{zt} + \ln(\text{size}_i) + X_z \delta + \varepsilon_{iz} \quad (4)$$

where the Δ refers to the change in the relevant variables between the years 1999 and 2014. The variable $\text{RescopingQuartile}_k$ is a dummy variable that equals one if the 3-digit zipcode's level of rescoping Δ_z was in quartile k, and Internet is the Internet usage. The variable directories is the number of RBOC directories in the zipcode. 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. The variable size denotes the fraction of the page covered by the advertisements, and the matrix X contains the change in demographic variables between 1999 and 2014.

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)
Internet	-0.263	-0.283	-0.283	-0.274	-0.257
	(0.0976)	(0.0982)	(0.100)	(0.0949)	(0.101)
Rescoping			0.0954		
			(0.0359)		
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
R-Squared	0.111	0.122	0.122	0.128	0.128

Notes: *p < 0:1, ** p < 0:05, *** p < 0:01. Robust standard errors reported. The dependent variable is the change in the logarithm ointiernetvngedep

the directories' populations. Thus, conditional on the number of directories in an area, this measure increases as the publishers use directories to cover di erently sized areas.

Formally, we de ne 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 de ne c^0_{zt} as the mean of coverage over directories in period t that cover 3-digit zipcode z. That is, $c^0_{zt} = \sum_{i 2 D_{zt}} c_{it} = n_{zt}$. Then, our measure of extended coverage coe cient of variation for 3-digit zipcode z in t is:

$$cv^e_{z;t} = \frac{\sqrt{\dfrac{\sum_{i 2 D_{zt}} (c_{it} - c^0_{zt})^2}{n_{zt} - 1}}}{c^0_{zt}}:$$

We compute our measure of

(a)

(b)

(c)

Figure 4: Coverage of directories of RBOC publisher in 3-digit zipcode 71 in 1999

(a)

(b)

(c)

Figure 5: Coverage of directories of RBOC publisher in 3-digit zipcode 71 in 2014

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