

Search Engine Advertising: Pricing Ads to Context

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Abstract

We explore how the ability to target ads affects substitution patterns across advertising platforms. Using data on the advertising prices paid by lawyers for 139 Google search terms in 195 locations, we exploit a natural experiment in “ambulance-chaser” regulations across states. When lawyers cannot contact clients by mail, making targeting customers offline harder, advertising prices per click for search engine advertising are 10-16% higher. However, this substitution between offline and online advertising occurs only for rarely-used search terms. This suggests that an advertising platform's ability to profit from targeting depends on both the difficulty of targeting through other means and the number of potential customers for that particular advertising message.

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1. Introduction

Online advertising has been one of the few advertising platforms that has shown revenue growth over the past 5 years.¹ One potential explanation of this shift is the ability of online advertising platforms to target advertising. In this paper, we use a natural experiment to quantify whether and when the need for targeting affects how much advertisers value search advertising.

Relative to most other types of advertising, search engine advertising makes it easier for advertisers to target hard-to-find customers, because ads are displayed only when a customer uses a certain search term. The price paid depends on an auction for that specific search term. Ads are therefore targeted and priced to the context of the search. For example, a lawyer who specializes in aviation accident lawsuits can buy an ad that is displayed only to people searching for “aviation accident lawyer.” However, it is hard to measure how the need for targeting affects the prices that advertisers are willing to pay for search engine advertising, because targeting needs are hard to observe and can be confounded with other unobserved factors.

In this paper, we use a natural experiment in the availability of offline targeting media to identify the importance of targeting to search engine advertisers. This experiment allows us to understand the interaction between targeting, offline media, and search engine advertising. Specifically, we exploit state-level variation in the ability of lawyers to solicit customers in cases related to recent personal injury or death.² Some state bar associations regulate this “ambulance-chasing” behavior by forbidding lawyers from contacting potential clients using traditional direct-response targeting methods (in writing or by e-mail) for 30-45 days after an accident.

We analyze the effects of these regulations using data on estimated auction prices of 139 different searches for various legal service “keywords” in 195 regional city markets. We regress

¹ This information is from PriceWaterhouseCoopers’ annual reports for the Interactive Advertising Bureau.

² Throughout the paper, we use “personal injury” to refer to both personal injury and wrongful death keywords. When referring specifically to personal injury and not wrongful death, we use the label “personal-injury-specific.”

a keyword's estimated cost per click on fixed effects for each location and keyword, and focus on an interaction variable that captures whether the keyword is affected by state regulations.

In locations with solicitation regulations, personal injury keywords cost advertisers between \$0.91 and \$1.48 (10–16%) more relative to the price of other keywords (such as “divorce lawyer”) in that state, compared with the price premium of personal injury keywords in non-regulated states. This suggests there is substitution in targeted advertising between online and offline channels. This contrasts with the alternative possibility that complementarity between targeted advertising in the online and offline channels, perhaps due to learning or economies of scope, dominates behavior.

We use three methods to check the robustness of our results to other potential sources of omitted variables bias and endogeneity. First, we include numerous controls to capture heterogeneity in the number of bidders, the client base, the local market for lawyers, awards in personal injury cases, and the civil litigation regime. Second, we show robustness to alternative definitions of treatment and control groups. Specifically, we use more limited control groups of keywords relating to traffic offences and family law, which are areas of law that, like personal injury law, are reputed to have aggressive lawyers. Third, we conduct two different falsification checks. Our first check focuses on Arkansas, where the solicitation restrictions affect wrongful death but not personal injury specifically; the solicitation restrictions in all other states apply to both personal injury and wrongful death. We show that, unlike other states with solicitation restrictions, keyword prices for personal injury-specific words are not disproportionately higher than other legal keywords in Arkansas, but are higher for wrongful death keywords. Our other falsification test examines a law governing lawyer behavior that is not restricted to personal injury lawyers. This ‘placebo’ regulation restricts the ability of all lawyers to advertise

specialties. We find no differential effect for this law on personal injury lawyer keywords. The results are robust: Online advertising prices are higher when solicitation is restricted.

We then explore how the extent to which advertisers value targeting is affected by the number of potential clients. We find that search engine advertising significantly substitutes for other direct marketing technologies only for keyword–city combinations with lower search volumes. Therefore, there is only evidence of substitution between search advertising and offline direct marketing communications when the advertising is aimed at a hard-to-reach market.

These results inform a new theoretical literature on how the ability to target affects advertising prices in equilibrium (Athey and Gans (2010); Bergemann and Bonatti (2009)). Both papers note demand and supply effects of targeting on advertising prices. Targeting may bid up prices through increased demand, but it may also reduce prices through increased supply (Athey and Gans 2010) or through reduced competition for advertising slots (Bergemann and Bonatti 2009). Both papers emphasize that reduced competition from one channel will increase prices in the other. Our results are strongly supportive of this last point: We show that prices rise when offline competition is restricted. Interestingly, the models in both papers imply that, consistent with our results, targeting is most valuable in the absence of channel competition.

This research also extends a previous empirical literature that has documented how better targeting of ads can increase advertiser and customer welfare. For example, Narayanan and Manchanda (2009) and Dong, Manchanda, and Chintagunta (2009) show that targeting improves pharmaceutical detailing; Goldfarb and Tucker (2010) document that targeted display ads are more effective in driving purchase intent. This emphasis on targeting effectiveness follows the theoretical literature in marketing, such as Iyer, Soberman, and Villas-Boas (2005) and Gal-Or and Gal-Or (2005), that has modeled the effects on advertiser and consumer welfare implied by

targeting. By contrast, this paper studies the benefits that a capacity to target brings to an advertising platform.

Our results also inform a growing literature on search engine advertising. The empirical literature on search engine advertising has also focused on the quality of customer leads post-click, rather than the ability to target. For example, Ghose and Yang (2009) and Rutz and Bucklin (2007) have shown the effects of different keywords on customer conversion. Our research adds to this literature, by emphasizing the role that targeting of keywords can have on advertisers' valuation of these advertising platforms.

This research offers managerial insight into the drivers of profitability for new media platforms. Overall, our results suggest that search engine advertising acts as a substitute for traditional forms of offline targeting. Experience in offline targeting could complement search engine advertising through learning and economies of scope, but our results suggest that search engine advertising, on balance, is a substitute for offline targeting tools. Furthermore, the result that this substitution is strongest in highly targeted markets suggests that search engines allow firms to reach the hardest to find customers, enabling a "long tail" in advertising (Anderson 2006). This suggests an efficiency-driven welfare improvement despite the high prices: Keyword search advertising is most valuable when customers cannot be reached through other channels.

2. Data on Advertising Prices for Lawyer Services

We use data collected from Google's "Traffic Estimator Tool," which provides potential advertisers with a guide to the auction prices that they would expect to pay for different keywords in different locations.³ The traffic estimator provides (given enough data points) a range of prices for each keyword that other advertisers have recently paid for an ad to appear in

³ Our focus on paid search as the source of revenues for search engines means we do not consider issues of non-paid search such as those discussed by Katona and Sarvary (2009).

the top three positions in a certain city and the search volume associated with that price range.⁴ Our data contain projections for 139 keywords in 195 geographic areas defined by Google to closely resemble (consolidated) metropolitan statistical areas. Our keywords cover many different types of legal representation, from "child custody lawyers" to "truck accident attorneys", and are summarized in Online Appendix Table 1. In order to use our natural experiment of state-level restrictions, we exclude metropolitan statistical areas that cross state lines, such as Burlington, VT–Plattsburg, NY and New Bedford, MA–Providence, RI. Table 1 provides descriptive statistics for the data used in this study.

Table 1: Descriptive Statistics

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Cost per click (midpoint)	12,271	9.28	7.650	0	52.87
Daily search volume	26,964	0.071	0.279	0	3
Personal injury keyword	26,964	0.187	0.389	0	1

There are two major challenges to using these data: Interpreting price data from an auction mechanism, and missing data. We discuss each in turn. With data from the Traffic Estimator Tool, we use the exact information advertisers have in setting their bid prices. Since 2002, Google and Yahoo have sold keywords using second-price sealed bid auctions instead of less-stable first-price auctions (Edelman *et al.* 2007). However, the form of second-price auction used obscures how bids translate into prices. An advertiser places a bid based on its maximum willingness to pay for an ad to appear next to a specific search term for a specific geographical location. Google then bills a sum lower than this maximum price whenever the ad is clicked. However, an advertiser is not necessarily paying the second price that was bid in that particular

⁴ Google also requests a maximum bid price. In all cases the maximum willingness to pay entered was \$100, to ensure that this did not bind the results.

auction. Instead, keyword prices post-bidding are adjusted for the quality of the website buying the keyword, click-fraud, and the clicks-to-impression ratio, with no information given to advertisers (or researchers) about the precise formulas used. In this paper, we use “estimated prices” data for Google that abstract from this *ex-post* quality adjustment. The key assumption for the interpretation of our results to be valid is that, on average, the relative price estimates reflect the relative values of the keywords in the market. In other words, measurement error will reduce the size of our estimates unless there is a systematic reason that personal injury keyword prices in states with solicitation regulation are overestimated using the Traffic Estimator Tool relative to all other keyword prices.⁵

Google reports the cost per click range only when they have enough historical data. Little (1992) emphasizes that missing data are problematic when systematically correlated with the explanatory variables. We run further regressions to establish that missing data in our dataset are not systematically correlated with the type of keyword or the solicitation regulations we use later in the paper for identification.

Another challenge of using these data is that Google gives a price range, but not an indication of the distribution of prices paid between these lower and upper cutoffs. We report results for the midpoint of this range. We have repeated all of our specifications using both the upper and lower limits, and obtained qualitatively similar results. Again, to support our qualitative results, all we need is for the keyword price estimates to be correlated with the actual prices paid and to have no other systematic correlation to the regulation.

⁵ In a separate dataset on search advertising for web services, we explored the correlation between the estimates provided by the traffic estimator tool and actual prices paid. We found that there was a correlation of over 0.95 between the prices suggested by the traffic estimator tool and the prices charged to the advertiser on the first two days of advertising, before Google had enough data to make quality adjustments.

2.1. Variation in Restrictions on Lawyer Behavior

Our natural experiment exploits state-level restrictions on personal injury lawyer behavior. Personal injury lawyers earned \$40 billion in 2004 in the United States, an amount that was more than 50% higher than Microsoft or Intel and twice that of Coca-Cola (Copland 2004). The personal injury lawyer industry has two attractive features that make the identification of how targeting difficulty affects search advertising prices relatively straightforward. These are: (1) sub-national markets due to state-level admittance to the bar and the small scale of personal-injury lawyer practices,⁶ and (2) variation in rules regarding solicitation by personal injury lawyers across states. We use this variation in solicitation regulations to establish whether search ads have higher prices when offline targeting is more difficult. The regulation gives us a natural experiment with a treatment group of locations affected by the regulation and a control group of locations that are not affected. To control for systematic differences between regulated and unregulated states, we contrast keyword prices affected by regulation with keyword prices that are unaffected by the state regulations in regulated states. Therefore, we estimate how much affected keywords diverge in price from unaffected keywords in regulated locations relative to unregulated locations.

The Supreme Court deregulated legal advertising in 1977 in *Bates v. the State Bar of Arizona*. This deregulation prompted a spate of empirical evaluation by marketing scholars (Kotler and Connor 1977; Smith and Meyer 1980; Darden *et al.* 1981) on legal services advertising. However, the deregulation was not complete: Some state bar regulations still prohibit lawyers from directly contacting potential clients who have recently sustained an

⁶ Although several states have reciprocity agreements with lawyers in other states, the small-scale nature of most personal injury claims means that cases are typically tried locally by local lawyers.

accident or injury.⁷ A typical text in a state bar manual is found in a section entitled “solicitation,” and reads:

“A lawyer shall not send, or knowingly permit to be sent, on a lawyer’s behalf or on behalf of the lawyer’s firm or on behalf of a partner, an associate, or any other lawyer affiliated with the lawyer or the lawyer’s firm, a written communication (including electronic communication) to a prospective client for the purpose of obtaining professional employment if the written communication concerns an action for personal injury or wrongful death arising out of, or otherwise related to, an accident or disaster involving the person to whom the communication is addressed or a relative of that person, unless the accident or disaster giving rise to the cause of action occurred more than X days before the mailing of the communication.”

Table 2 records all regulations as of April 2007 where a state bar association forbids written communication with potential clients. In each case, “written communication” includes direct electronic communication such as e-mail.⁸ There is a little variation over how long the states prohibit contact (the mode is 30 days), but the regulations are similar. These regulations affect a significant part of lawyer advertising behavior. In 1989, before the change in bar association regulation in Florida, the association reported that of 700,000 direct solicitations sent, 40% were to accident victims or their relatives.

⁷ The Supreme Court considered this matter in *Florida Bar v. Went for It, Inc.* (Supreme Court of the United States 1995). It was a close five-to-four decision, but the majority ruled that while such practices may limit free speech, states also have a constitutional right to protect the privacy of their citizens. The decision refers to some interesting anecdotal evidence that was used to justify the ruling and solicitation regulations such as those studied in this paper. For example, a Florida citizen described how he was “appalled and angered by the brazen attempt” of a law firm to solicit him by letter shortly after he was injured and his fiancée was killed in an auto accident. Another citizen described a letter his nephew’s family received on the day of the nephew’s funeral as “beyond comprehension”. One citizen wrote, “I consider the unsolicited contact from you after my child’s accident to be of the rankest form of ambulance chasing and in incredibly poor taste...I cannot begin to express with my limited vocabulary the utter contempt in which I hold you and your kind.”

⁸ In-person and telephone solicitations are barred by all state bars for all types of lawsuits if a prior business relationship does not exist. The written communication restrictions have been strict enough that St Louis attorney Ryan Bradley has reportedly tried to circumvent them by “blogging” about personal injury victims by name in the hope of catching the attention of either the victim or the relatives (Turkewitz 2007).

Table 2: Bar regulations/rules prohibiting contact with clients

State	Personal injury regulations
Alabama	No written communication allowed for 30 days for personal injury or wrongful death
Arizona	No written communication allowed for 30 days for personal injury or wrongful death
Arkansas	No written communication allowed for 30 days for wrongful death
Colorado	No written communication allowed for 30 days for personal injury or death
Connecticut	No written communication allowed for 40 days for personal injury or death
Florida	No written communication allowed for 30 days for personal injury or wrongful death
Georgia	No written communication allowed for 30 days for personal injury or wrongful death
Hawaii	No written communication allowed for 30 days for personal injury or wrongful death
Louisiana	No written communication allowed for 30 days for personal injury or wrongful death
Missouri	No written communication allowed for 30 days for personal injury or wrongful death (accident or disaster)
Nevada	Must wait 45 days after any known event before written communication
New York	No written communication allowed for 30 days for personal injury or wrongful death unless law says need to file in 30 days in which case cannot solicit for 15 days
South Carolina	No written communication allowed for 30 days for personal injury or wrongful death
Tennessee	No written communication allowed for 30 days for workers' comp., personal injury, or wrongful death
Wyoming	For written communications, need to wait 30 days after "occurrence" before soliciting a specific client

Personal injury keywords can be identified objectively because bar associations use a precise legal definition to define what is a personal injury case and what is not. *Personal injury* is damage to an individual rather than property. It covers accidents, medical negligence, and industrial diseases contracted by workers at their workplace. The personal injury keywords we identified cover regular accidents, as well as industrial diseases such as mesothelioma where regulations apply after diagnosis or death.⁹

3. Estimation Strategy and Results

Using data on the prices of keywords across cities, we examine the responsiveness of keyword prices to this variation in how easy it is to target customers offline. Descriptive statistics of keyword prices across regulatory regimes suggest that the regulations have an effect: Keyword prices are \$0.28 higher in states with solicitation regulation. This may, however, be a result of unobservable differences in the willingness to pay across keywords and locations. To control for these unobservable differences, we include fixed effects (i.e. dummy variables) for

⁹ The keywords, and whether they were categorized as personal injury keywords, are listed in the online appendix.

each location l and each keyword k , and focus on the interaction between whether a keyword relates to personal injury and whether there is personal injury regulation in that state. The location fixed effects allow us to control for all city-level differences, including wealth, internet penetration, and litigiousness. The keyword fixed effects allow us to control for all keyword-level differences. Therefore, this empirical strategy allows us to control for *differences* in prices that occur because personal injury keywords are different from other keywords, and also *differences* in prices that occur because states that enact personal injury regulation are different from states that do not. This is known as a “difference-in-differences” approach. Usually in difference-in-differences, researchers take the approach of using a prior time period not affected by the policy to control for geographical cross-sectional variation in customer behavior. Since these regulations were enacted before keyword search even existed, in this paper we use *other keywords* instead of a time series to control for this cross-sectional variation in consumer behavior. As long as there is no other systematic reason why personal injury keywords should be differently priced from non-personal injury keywords in states with regulation, we can interpret the interactions β as measuring the causal effect of the regulations on prices.

$$[1] \text{ CostPerClick}_{kl} = \beta(\text{PersonalInjuryWord}_k) \times (\text{SolicitationRestricted}_l) + \text{Keyword}_k + \text{City}_l + \gamma \text{Controls}_{kl} + \varepsilon_{kl}$$

We estimate equation [1] using a variety of specifications. Column 1 of Table 3 displays the results of our base specification. The estimates for the interactions suggest that solicitation regulations affect the prices that lawyers pay for personal injury search terms.

The presence of a solicitation regulation is associated with a \$1.01 increase in the price of a personal injury keyword. These results suggest that when state bar regulation makes it harder to contact personal injury victims using other marketing communications channels, lawyers are willing to pay relatively more for advertising next to a personal injury search. Search engine

advertising appears to be a substitute for offline marketing communications. This effect appears to dominate any value of expertise in offline direct response media or of economies of scope across media platforms.

Table 3: Main Results and Robustness to Different Dependent Variables/Specifications

	(1)	(2)	(3)	(4)
Dependent variable	Midpoint CPC	Max CPC	Min CPC	Log CPC
Personal injury keyword <i>and</i> Rule restricting solicitation	1.013*** (0.297)	1.112*** (0.384)	1.611*** (0.254)	0.0519** (0.021)
Observations	12,271	12,271	5067	12,264
R^2	0.81	0.85	0.66	0.89

All regressions include a full set of fixed effects for each city and each keyword. Robust standard errors clustered at the keyword level are given in parentheses. CPC, cost per click. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Our finding that advertising prices are higher for personal injury keywords relative to other keywords in the same location when there is a rule restricting solicitation is robust to different definitions for the dependent variable. Columns (2) to (4) of Table 3 show a similar pattern of positive and significant results for the lower and upper limits of the range of the cost per click and the log value.

The identifying assumption behind our results is that there is no unobserved factor that leads states to adopt regulations that restrict solicitation and that also leads personal injury lawyers to be willing to pay more for internet advertising relative to other lawyers. However, it is possible that the states that enacted anti-solicitation legislation have personal injury lawyers whose behavior is systematically different from other states. For example, it could be that a state that has a more media-savvy population is more likely to prohibit advertising by lawyers, and that representation of this media-savvy population is also more profitable in personal injury cases. Or, it could be that the kind of states that enact such rules have a certain level of

sophistication which means that they attract more highly educated personal injury lawyers relative to states that do not; and that in those states, the more highly educated personal injury lawyers have a higher success rate at prosecuting cases and consequently are willing to pay more for advertising.

We address this omitted variable bias in three ways. First, we include controls for the number of potential litigants, the number of lawyers, and the size of expected payout. Second, we adjust the control group to more tightly resemble personal injury lawyers in advertising behavior and scope. Third, we use two falsification tests. One test shows that, in a place where the law applies to wrongful death cases but not personal injury cases, only the appropriate words have higher prices. The other shows that a restriction on advertising behavior (which is likely to be motivated by similar confounds as the solicitation restrictions) that is not limited to personal injury lawyers has no different effect on personal injury lawyers' willingness to pay for keywords. We discuss these strategies in detail in the remainder of this section.

3.1 Further Controls for Unobserved Heterogeneity

There may be factors in each city that we have not yet controlled for that affect personal injury advertising more than other types of advertising. To examine the likelihood of this alternative, we show the robustness of our results to many additional controls in order to address omitted variables bias—the idea that personal injury lawyers in states that enacted the solicitation restrictions are willing to pay more for ads for reasons other than the restrictions themselves. We gathered additional information about the locations from a variety of sources. Table 4 describes the additional control variables, their sources, and some summary statistics. The fixed effects for each location capture heterogeneity that affects average lawyer advertising

behavior. Therefore, most of the variables enter as interactions with the personal injury keyword dummy, since the main effect is captured by the fixed effects.

Table 5 shows that, with these controls, the interaction of Personal Injury Keyword and Rule Restricting Solicitation remains significant within a narrow range.¹⁰ Columns (1) to (5) add controls for market size (search volume, wealth, and population). These controls address alternative explanations for our results based on population size and wealth (for example, larger, richer places are more likely to have ambulance-chaser regulations and also to attract more personal injury lawyers).

Columns (6) and (7) of Table 5 add controls for differences in the level of legal activity across local legal markets (the number of civil cases and lawyers per capita). This helps rule out the possibility that personal injury lawyers move into “respectable” states (defined by the presence of solicitation restrictions) and consequently bid up prices.

Columns (8) and (9) of Table 5 add controls for differences in how profitable it is to launch a personal injury lawsuit. The indicator for whether or not the city is a “judicial hell hole” as defined by the American Tort Reform Institute measures how likely juries are to award a large settlement to a plaintiff in a personal injury case. The indicator for medical malpractice payments indicates how large the average payoff is for medical malpractice cases, which is another proxy for how generous juries/the trial system tends to be in personal injury cases. This addresses alternative explanations, such as a theory where solicitation regulations are enacted in states where firms face large payouts and consequently lobby to curb ambulance-chaser behavior, but where large payouts also attract higher-quality personal injury lawyers who bid higher on keywords.

¹⁰ The addition of many controls changes the R^2 very little. This is not unusual in models with many fixed effects where the fixed effects capture a great deal of the variation in the data (e.g. Athey and Stern 2002).

Table 4: Control Variable Description

Variable label	Variable description	Data source	Mean	Standard deviation
SearchVolume	Search volume predicted for that keyword in that city	Google	0.07	0.28
GSP	Gross state product (\$100,000) per capita	US Bureau of Economic Analysis	0.40	0.06
MSAPopulation	City population (10,000)	US Census (2006)	9.86	9.24
StatePopulation	State population (millions)	US Census (2006)	10.86	9.04
CivilCasestoPop	Total state trial courts' incoming civil cases per 100,000 residents (excluding domestic-relations cases)	Courts Statistics Project, National Center for State Courts ^a	0.06	0.03
MSALawOfficestoPop	Number of businesses that provide legal services in the city (defined by the Metropolitan Statistical Area or MSA) divided by MSA Population (in 100,000s)	US Census (2006) ^b	6.13	3.24
JudicialHellHole	Whether city is described as a "judicial hell hole" by the American Tort Reform Association	ATRA (2006)	0.03	0.16
AvgMalpracticePayment	Average size of medical malpractice payment (\$100,000)	National Practitioner Data Bank	2.64	0.96
ManyBidders	Whether there are more bidders than can typically fit on the first page	Google	0.065	0.24

^aData unavailable for Oklahoma.

^bLaw offices per capita data are unavailable for Palm Springs CA, Presque Isle ME, and Glendive MT.

Table 5: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Personal injury keyword <i>and</i> Rule restricting solicitation	0.984*** (0.294)	0.972*** (0.304)	1.011*** (0.306)	1.017*** (0.311)	1.180*** (0.344)	1.270*** (0.376)	1.246*** (0.370)	1.216*** (0.362)	1.258*** (0.370)	1.255*** (0.364)	1.256*** (0.364)
(2) SearchVolume	-1.212*** (0.245)	-1.610*** (0.274)	-1.572*** (0.268)	-1.397*** (0.250)	-1.362*** (0.245)	-1.353*** (0.244)	-1.350*** (0.244)	-1.354*** (0.244)	-1.345*** (0.242)	-1.344*** (0.242)	-1.339*** (0.241)
(3) Personal injury keyword × SearchVolume		2.968*** (0.591)	2.754*** (0.575)	1.532*** (0.574)	1.247** (0.566)	1.249** (0.562)	1.230** (0.561)	1.297** (0.575)	1.252** (0.567)	1.281** (0.581)	1.273** (0.581)
(4) Personal injury keyword × GSP			7.368*** (1.989)	5.531*** (2.004)	2.151 (1.500)	3.706* (1.938)	2.950* (1.766)	2.862 (1.736)	4.599** (2.209)	4.624** (2.263)	4.600** (2.262)
(5) Personal injury keyword × MSAPopulation				0.238*** (0.0727)	0.183** (0.076)	0.184** (0.075)	0.182** (0.075)	0.192*** (0.072)	0.210*** (0.072)	0.209*** (0.073)	0.209*** (0.073)
(6) Personal injury keyword × StatePopulation					0.078*** (0.018)	0.074*** (0.017)	0.077*** (0.018)	0.079*** (0.019)	0.070*** (0.018)	0.070*** (0.017)	0.070*** (0.017)
(7) Personal injury keyword × CivilCasestoPop						-6.880** (2.951)	-6.533** (2.902)	-6.867** (2.984)	-6.910** (3.011)	-6.933** (3.039)	-6.896** (3.040)
(8) Personal injury keyword × MSALawOfficestoPop							0.033* (0.018)	0.050** (0.024)	0.046** (0.023)	0.047* (0.025)	0.046* (0.025)
(9) Personal injury keyword × JudicialHellHole								-0.688 (0.452)	-0.745 (0.462)	-0.746 (0.462)	-0.744 (0.462)
(10) Personal injury keyword × AvgMalpracticePayout									-0.225** (0.093)	-0.224** (0.093)	-0.224** (0.093)
(11) Personal injury keyword × ManyBidders										0.109 (0.430)	-0.210 (0.464)
(12) ManyBidders											0.322* (0.189)
(14) Observations	12,271	12,271	12,271	12,205	12,205	12,055	12,055	12,055	12,055	12,055	12,055
(15) R ²	0.81	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82

Dependent variable: the midpoint of the keyword's estimated cost per click. Robust standard errors clustered at the keyword level are given in parentheses. All regressions include a full set of fixed effects for each city and each keyword. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Columns (10) and (11) of Table 5 add the controls for the estimated number of bidders in the keyword auction. The number of bidders is a highly endogenous measure of market size as it is likely to be related to unobserved market characteristics and the coefficients should not be interpreted.¹¹ Again, the qualitative results for the solicitation restriction do not change. This lack of change suggests that is not variation in the number of bidders that is driving our results. It also suggests that the higher bids for affected keywords in affected states are not merely a reflection of a higher number of bidders in the auction, but instead an additional increase in the valuation by those bidding for the affected keywords in the affected states.

While the main focus of Table 5 is to show the robustness of the core result, the coefficients on the controls are themselves interesting. For example, the main effect for search volume shows that high-volume words generate lower prices. However, the interaction of personal injury keyword and search volume is consistently positive and significant. One explanation for this result is that customers start relatively more searches for personal injury keywords in locations where personal injury cases are more valuable compared to non-personal injury cases. For example, if there are more searches for an “Asbestos Lawyer,” this may signal that there may be a real and dangerous level of exposure to asbestos in that location. This would in turn make an asbestos case more valuable there. However, if there are more searches for a “Tax Lawyer” or “Divorce Lawyer,” then this might not signal anything about the potential payoff to the lawyer of taking on either a tax case or a divorce case in that city. This result highlights the endogeneity of the search volume to unobserved market conditions and underscores the importance of our natural experiment setting.

¹¹ We have also checked that our results in the remainder of the paper are not affected by the inclusion of this highly endogenous variable. The qualitative results do not change and the coefficients of interest change very little if this variable is excluded.

The results also show that personal injury keyword prices are particularly high in wealthy (rows 5 and 6), high-population (row 4) places with a large number of lawyers (row 8). Perhaps surprisingly, personal injury keyword prices are lower in places with a relatively high number of civil cases (row 7) and a relatively high level for average medical malpractice payouts (row 10). Row 12 shows that having more bidders is associated with higher keyword prices, perhaps due to a more competitive keyword auction.

Although adding these controls does not fully address the endogeneity of the solicitation rules, the robustness of our results to controls for the size of the market, the number of lawyers, and the likely rewards of a personal injury lawsuit allows us to discount the most obvious alternative explanations for the relationship between solicitation restrictions and keyword prices.

3.2 Robustness of Control Groups

Table 5 helps us discount alternative explanations of our results based on heterogeneity that we can measure, but there may still be alternative explanations based on heterogeneity that we cannot measure. One way of addressing alternative explanations based on unobserved heterogeneity is by using a control group that is likely to be subject to the same unobserved heterogeneity. For example, one alternative explanation for our result could be that personal injury lawyers spend more on yellow pages advertising than other lawyers. States with solicitation regulations that restrict offline advertising could also be states where a general distaste for advertising means that residents do not often consult their yellow pages. Personal injury lawyers therefore may be forced online by the anti-advertising spirit in that state, rather than by the anti-solicitation regulation.

To address these (and similar alternative explanations linked to differences in advertising behavior between personal injury lawyers and other lawyers), we sought a more limited control group of lawyers who use similar advertising media to personal injury lawyers, using some of the more specific subsets of keywords. We found such a group in lawyers who pursue drunk-driving and traffic violation cases (“DUI lawyers”).¹² Another group of lawyers who also advertise widely but are not bound by solicitation restrictions are family (divorce) lawyers. Repeating the exercise using divorce lawyers as a control group gave us similar results.¹³ The results in columns (1) and (2) of Table 6 have the flavor of a regression discontinuity approach, in that we try to identify as close a group as possible and make the assumption that the unobserved heterogeneity is likely to be similar across the treatment and control groups.¹⁴

One difference between the two columns is that the coefficient for SearchVolume is negative for the regression that uses divorce keywords as controls and positive for the regression that has traffic offense keywords. Further analysis suggested that this is likely due to regional variation in the use of the terms “DWI”, “DUI”, and “OUI” to describe drunk driving offences across the group of controls we use for the traffic violation regressions. If, for example, a region tends to use the code “DWI” to describe a drunk driving offense, then it is likely that more people will use that search term in that city, and also that people who use that search term could be more profitable potential clients, because they could be searching using the actual term on their traffic citation.

¹² DUI lawyers are also an attractive control group because their advertising tactics have also been criticized as bringing the legal profession into disrepute. For example, some DUI firms have been criticized for selling personal breathalyzer tests with their firm name and telephone number (Jaffe 2008).

¹³ Divorce lawyers have also been criticized for “sleazy” advertising. For example, an ad featuring a scantily clad woman proclaiming “Life's short. Get a divorce.” recently attracted controversy in Chicago (Johnson 2007).

¹⁴ This is a non-standard application of a regression discontinuity approach. Usually this approach exploits the fact that assignment to the treatment is based on some continuous measure (such as time, as used by Busse *et al.* 2006) as opposed to the discrete assignment implied by the definition of personal injury cases in our study. The specific keywords in each category are shown in Online Appendix Table 1.

Table 6: Varying the Control Group

Control Group	(1) Only traffic offenses as controls	(2) Divorce lawyers as controls	(3) Only non-specific keywords as controls	(4) Diluted definition
Personal injury keyword <i>and</i> rule restricting solicitation	1.439*** (0.293)	1.196*** (0.331)	1.671*** (0.439)	1.079*** (0.336)
SearchVolume	3.537*** (1.179)	-2.004*** (0.463)	-1.845*** (0.502)	-1.345*** (0.242)
Personal injury keyword × SearchVolume	-4.491*** (1.276)	1.395** (0.673)	1.387* (0.716)	1.290** (0.585)
Personal injury keyword × GSP	2.340 (2.435)	2.127 (2.148)	6.891** (2.697)	4.359* (2.229)
Personal injury keyword × MSAPopulation	0.055 (0.102)	0.247*** (0.074)	0.334*** (0.094)	0.210*** (0.073)
Personal injury keyword × StatePopulation	0.075*** (0.024)	0.076*** (0.024)	0.069*** (0.017)	0.070*** (0.017)
Personal injury keyword × CivilCasestoPop	-3.539 (3.743)	-4.379 (3.172)	-11.166*** (3.756)	-6.624** (2.998)
Personal injury keyword × MSALawOfficestoPop	0.099** (0.045)	0.039 (0.026)	0.072** (0.029)	0.052** (0.026)
Personal injury keyword × JudicialHellHole	-0.031 (0.774)	-0.139 (0.540)	-1.003* (0.563)	-0.840* (0.471)
Personal injury keyword × AvgMalpracticePayout	-0.300** (0.136)	-0.095 (0.133)	0.484*** (0.115)	-0.211** (0.092)
Personal injury keyword × ManyBidders	0.361 (0.513)	-1.197* (0.723)	-1.644 (1.151)	-0.213 (0.464)
ManyBidders	-0.209 (0.256)	1.376** (0.570)	1.746 (1.058)	0.329* (0.189)
Observations	3613	4129	4968	12,055
R^2	0.66	0.71	0.80	0.82

Dependent variable: midpoint of the keyword's estimated cost per click. Robust standard errors clustered at the keyword level are given in parentheses. All regressions include a full set of fixed effects for each city and each keyword. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We use two additional definitions of the control group to check the general robustness of our specification. In column (3) of Table 6, we show a more limited regression that used only non-specialty keywords (e.g. “lawyer”, “lawsuit”, “litigation”) as the control group. In column (4) of Table 6 we broadened the definition of personal injury to take into account the few circumstances where there may be both personal injury and injury to property in a civil suit. For example, “toxic mold attorneys” may litigate for both personal injury damages and property damages. This observation added the keywords associated with “dog bites”, “mold”, “toxic

“mold”, “premises liability”, “food poisoning”, and “nursing home abuse” to the treatment group. We tried including and excluding these “combined” civil cases, and obtained qualitatively similar results (although slightly diluted, as expected).

3.3 Falsification Checks

We also checked the robustness of our results by conducting two falsification exercises. In the first falsification exercise, the aim is to examine a set of keyword-location interactions that should be subject to similar unobserved heterogeneity as the treated group but should not actually be affected by the solicitation restrictions. Specifically, we exploit the difference in the scope of the regulation in Arkansas relative to the other fourteen states with solicitation regulations. The Arkansas regulation *only* applies to wrongful death solicitation. All other states forbid solicitation for both personal injury specifically and wrongful death. We separate our keywords into a group related to wrongful death and a group related to personal injury.¹⁵ If unobserved heterogeneity associated with the behavior of ambulance-chasing lawyers in states that enact solicitation restrictions is driving our results, we would expect to observe a price premium for personal injury keywords in Arkansas, even though these keywords are not covered by the law.

In Table 7, we show that wrongful death keywords have a price premium in Arkansas and in the other fourteen states with solicitation regulations. In contrast, personal injury-specific keywords have a price premium in the fourteen states where solicitation regulations cover personal injury specifically, but not in Arkansas. The three rows show differences in the price

¹⁵The personal injury-specific words are “personal injury”, “birth injury”, “brain injury”, “dog bite”, “car accident”, “construction accident”, and “food poisoning”. The wrongful death words are “wrongful death”, “aviation accident”, “asbestos”, “medical malpractice”, “mesothelioma”, and “truck accident”. We recognize that the assignment for some of these keywords is somewhat arbitrary and have checked qualitative robustness to minor changes in the assignment such as categorizing car accident, construction accident, or food poisoning as wrongful death words or categorizing asbestos, medical malpractice, mesothelioma, or truck accident as personal injury-specific words.

premium for wrongful death keywords, personal injury-specific keywords in the fourteen states that regulate personal injury solicitation, and personal injury-specific keywords in Arkansas where personal injury solicitation is not restricted (although wrongful death solicitation is). Columns (1) and (2) of Table 7 combine all states. Column (3) shows results that include only Arkansas as a regulated state. Column (4) of Table 7 looks at all states except Arkansas. The lack of a positive coefficient on personal injury-specific words in Arkansas suggests that unobserved heterogeneity is not the driving force behind our results. Instead, it suggests that the price premiums that we observe in the data follow directly from the wording of the law.

Table 7: Falsification Check using Different Law Specification in Arkansas

	(1)	(2)	(3)	(4)
	All states	All states	Arkansas and states without regulations	All states except Arkansas
Covered wrongful death keyword <i>and</i> law restricting solicitation	1.335*** (0.384)	1.584*** (0.452)	4.937** (1.532)	1.487*** (0.428)
Covered personal injury-specific keyword (not death) <i>and</i> law restricting solicitation	0.617* (0.244)	0.823** (0.291)		0.796** (0.287)
Not covered personal injury-specific keyword (not death) <i>and</i> law restricting solicitation	-0.777 (1.373)	0.0240 (1.339)	-2.004 (1.602)	
Full set of interactions from Table 4	No	Yes	Yes	Yes
Observations	12271	12055	8045	11897
R^2	0.814	0.819	0.802	0.818

Dependent variable: midpoint of the keyword's estimated cost per click. Robust standard errors clustered at the keyword level are given in parentheses. All regressions include a full set of fixed effects for each city and each keyword. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As a second falsification check, we repeated our study using an alternative, similarly motivated, advertising regulation that does not apply specifically to personal injury lawyers: Specialization disclosure requirements. States with these regulations require a disclosure that the

state does not certify or recognize lawyers in specialty practices when lawyers advertise themselves as experts in a field of practice.¹⁶ Like the solicitation restrictions, it is meant to temper the excesses of lawyer advertising. However, it applies to both online and offline advertising. Furthermore, unlike solicitation restrictions, it does not apply only to personal injury lawyers (e.g. divorce lawyers cannot advertise themselves as specializing in divorces without a disclaimer). Therefore, the regulation itself should not affect personal injury lawyers differently from other lawyers. These regulations are also enacted by states in response to “aggressive behavior” on the part of lawyers. If the endogeneity of the “ambulance-chaser” regulations explains our results, then we would also expect such rules to be associated with a positive effect on personal injury keyword prices. This gives us a way to examine the role of the endogeneity of the rule in driving our results. Table 8 displays the results. As expected, because the regulation applies to all groups, it does not affect personal injury lawyers in a different way than it affects other lawyers. The specialization limitation on advertising behavior is closer in spirit to that of the solicitation restrictions than the tort reform laws which are predominantly financial controls, so it is reassuring that its coefficient is insignificant and the opposite sign to the solicitation restriction coefficient.

As a further “reality check,” we reran our regressions using another example of a regulation directed at curbing aggressive personal injury lawyer behavior directly through their expected income from the case: Regulations that restrict the use of contingency fees. A contingency fee is a fee payable only in the case of a favorable result. While there is substantial variation in the specifics of the contingency fee regulations, they all ultimately limit how

¹⁶ There are specialization disclosure requirements in Colorado, Illinois, Iowa, Kansas, Massachusetts, Mississippi, Missouri, Nevada, Rhode Island, South Dakota, Texas, Utah, Washington, West Virginia, and Wyoming.

profitable it is to represent a personal injury client.¹⁷ Thus, in contrast to solicitation restrictions, we expect the restrictions on contingency fees to *decrease* keyword prices. These results are also reported in Table 8. As expected, we find that contingency fees have a negative impact on keyword prices for personal injury keywords, while rules restricting the advertising of specialties do not have a differential effect.¹⁸

Table 8: Falsification Checks using Regulation

	(1)	(2)	(3)	(4)	(5)
Personal injury keyword <i>and</i> Rule restricting advertising of specialties	-0.258 (0.279)		-0.145 (0.255)		-0.192 (0.260)
Personal injury keyword <i>and</i> Rule restricting contingency fees		-2.669*** (0.763)		-2.165*** (0.683)	-2.177*** (0.690)
Personal injury keyword <i>and</i> Rule restricting solicitation			1.246*** (0.351)	0.921*** (0.310)	0.906*** (0.296)
Observations	12,055	12,055	12,055	12,055	12,055
R^2	0.82	0.82	0.82	0.82	0.82

Dependent variable: the midpoint of the keyword's estimated cost per click. All regressions include a full set of fixed effects for each city and each keyword as well as the full set of controls in column (11) of Table 5 column 11 (as shown in the online appendix). Robust standard errors clustered at the keyword level are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Substitution is strongest when there are fewer potential clients

So far we have focused on the availability of offline targeting tools through state solicitation regulation. However, bidding behavior may also be affected by the “difficulty of targeting,” that is, how hard it is for lawyers to identify clients. To investigate how channel substitution and the need for targeting are affected by the difficulty of targeting, we stratify our results by the number of potential clients in the market. When the target customers are a small fraction of the market, mass advertising may not be cost-effective. Hence, firms need a mechanism for targeting markets with few customers (“thin” markets) offline or online. We

¹⁷ There are contingency fees restrictions in Alaska, Illinois, Maine, Nebraska, Oklahoma, and Wisconsin.

¹⁸ We also ran interactions with other state regulations that cover tort reform and our results remained robust.

expect the need for targeting, as proxied by the solicitation regulation, to matter in thin markets, as there are few other alternatives to the offline channel for reaching these customers. In contrast, when there are many potential clients, firms may find that using mass media to advertise is reasonably cost-effective.¹⁹

Table 9 shows the relationship between difficulty of targeting and keyword prices for thin and not-thin markets. When there are more potential clients (>1 search per day), the difficulty of targeting offline, as measured by solicitation laws, has an insignificant relationship to prices. When the search volume is low (<1 search per day), there is a positive and significant relationship between solicitation regulation and personal injury keyword prices. We also find similar results when we split our results by the number of law offices per head (an alternate measure of the litigiousness of that state or the thinness of the legal market). We control for the number of bidders in the regressions directly in the interaction term for number of bidders, so our stratified results capture market thinness better from the customer than the lawyer side.

We interpret this as suggesting that the difficulty of targeting offline affects prices only when there are fewer matches to be made. This suggests that the two components of targeting (the need for targeting and the difficulty of targeting) do not operate independently. When targeting using offline media is prohibited by solicitation laws, but the market for clients is not thin, demand for search engine advertising (as measured through the price) does not appear to rise. This may be explained by firms substituting instead into mass-media advertising, such as billboards soliciting car accident victims along highways. Search engine advertising, on the other hand, substitutes for offline targeted advertising when customers are sparse and consequently more difficult to reach cost-effectively via the mass media.

¹⁹ Direct solicitation is used widely when it is allowed by law, so it is unlikely that our results are a consequence of a lack of direct solicitation by lawyers in markets that are not thin.

Table 9: Stratification by need for targeting

	(1)	(2)	(3)	(4)
Personal injury keyword <i>and</i> law restricting solicitation	-0.181 (0.194)	0.942*** (0.310)	0.437 (0.301)	1.746*** (0.448)
Observations	1,735	10,320	6,591	5,464
R^2	0.98	0.81	0.83	0.81
Sample	Search volume of one or more per day	Search volume less than one per day	Above median number of law offices per capita	Below median number of law offices per capita

Dependent variable: the midpoint of the keyword's estimated cost per click. All regressions include a full set of fixed effects for each city and each keyword and the full set of controls in column (11) of Table 5 as well as including contingency fee restrictions and specialization disclosure requirements. Robust standard errors (clustered by keyword) are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Conclusion

We show that targeting plays an important role in understanding when search engine advertising is valuable relative to offline marketing communications channels. To identify a causal relationship between the difficulty of finding clients offline and search engine advertising prices, we have used an exogenous shifter of the ability of offline marketing communications technologies to reach the target market: Anti-solicitation regulations that in several states forbid personal injury lawyers to contact potential clients directly. When lawyers are forbidden to contact a personal injury or wrongful death claimant directly, the price of a personal injury keyword is \$0.91 to \$1.48 higher (depending on the specification) in that state relative to other personal injury keywords. So, when the value of targeting increases because alternative targeting mechanisms are unavailable, the value of search advertising increases. This shows that search engine advertising is a substitute for targeted offline marketing communications. This effect dominates any possible complementarities from learning or economies of scope between the two.

Given the potential endogeneity of the solicitation restriction and the possibility of omitted variables bias, we have performed numerous robustness checks to look for evidence that

our results are a consequence of spurious correlation. First, we included controls for the number of likely clients, the number of lawyers, and the likelihood of a large personal injury settlement. Second, we showed that when we limit our control group to very closely related sets of lawyers, the results are unchanged. Third, we used two falsification tests. We showed that, in a state where only wrongful death solicitation is affected (and not personal injury-specific solicitation), we see a price premium for wrongful death words but no price premium for personal injury-specific words. We also showed that other restrictions on lawyers' general behavior that are likely to have similar underlying motivation (to curb lawyer advertising excesses and false claims) do not have the same impact. The core results are robust across all specifications.

The relationship between solicitation restrictions and the price of personal injury keyword advertising holds only when the number of potential customers is small. When there are many searches for a keyword, there is no significant relationship between solicitation regulations and personal injury keyword prices. However, if there are very few searches for a keyword, then restrictions on alternative targeted communications channels have a large effect on the price that is independent of the specificity of the keyword. This suggests that firms value the advertising technology improvements associated with context-based search advertising primarily when the customers of interest are a relatively small fraction of all customers. It is in these cases that search engine advertising is a close substitute for offline direct advertising. When there are many people in the target audience, advertisers do not switch to search advertising, perhaps because in that situation they find that mass-media advertising provides a reasonably cost-effective alternative. This means that, consistent with the theoretical models in Athey and Gans (2010) and Bergemann and Bonatti (2009), targeting affects advertising prices when competition is scarce.

The research also highlights an unexpected benefit that restrictions designed to enhance personal privacy can have for search engines. The restrictions on active solicitation of clients by lawyers that we study are designed to prevent unseemly intrusion into the lives of grieving families at a time of particular fragility. In this way, search engines allow people to gather useful information without unwanted intrusions on their privacy. Thus, while search engines are often accused of gathering private information and violating secrecy-related privacy concerns,²⁰ they might also play a useful role in overcoming privacy concerns related to intrusive behavior.

There are obvious limitations to our study. This is a study of an online advertising behavior in a narrow sector (law-related keywords) that may not be representative of behavior in other sectors. We focus on identifying the effect of the “need for targeting” using variation in state regulations, so we ultimately study the behavior of advertisers who wish to target offline but cannot, and who therefore resort to online targeting. Future studies could valuably frame the question of studying the effects of “the need for targeting” more broadly. With the growing prevalence and significance of behavioral advertising online, the broader question of how “the need for targeting” affects both firm and customer behavior will become even more important.

Notwithstanding these limitations, we believe our findings suggest an important link between targeting, offline marketing communications, and search engine advertising. More generally, our results suggest that advertising-platform managers and antitrust authorities should recognize that the profitability of search markets is very dependent on alternative advertising channels and marketing restrictions, both online and offline. Finally, our results suggest an efficiency welfare-improving role for search engine advertising that enables firms to send informative ads to customers that would be otherwise hard to reach.

²⁰ For example, Google is under investigation in Germany for contravening privacy law restrictions on the retention of IP addresses (Jakobs 2009).

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