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Search Engine Advertising: Channel Substitution when Pricing Ads to Context

Avi Goldfarb and Catherine Tucker*

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Abstract

We explore 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, advertising prices per click for search engine advertisements are 5-7% higher. Therefore, online advertising substitutes for offline advertising. This substitution towards online advertising is strongest in markets with fewer customers, suggesting that the relationship between the online and offline media is mediated by the marketers’ need to target their communications.

*Avi Goldfarb is Associate Professor of Marketing, Rotman School of Management, University of Toronto, 105 St George St., Toronto, ON. Tel. 416-946-8604. Email: agoldfarb@rotman.utoronto.ca. Catherine E. Tucker is Assistant Professor of Marketing, MIT Sloan School of Business, 1 Amherst St., E40-167, Cambridge, MA. Tel. 617-252-1499. Email: cetucker@mit.edu. We wish to thank Jayne Huang for excellent research assistance. We also wish to thank the review team, Chris Dellarocas, Shane Frederick, Anindya Ghose, Shane Greenstein, and seminar participants at SCECR 2007, LBS, the NET Institute conference (2008), the Fourth Workshop on Ad Auctions, and the University of Toronto for comments. We thank the NET Institute (<http://www.NETinst.org>) for financial support.

1. Introduction

Online advertising has been one of the few advertising platforms that has shown revenue growth over the past 5 years.¹ An important question for marketers and policy makers is whether this growing advertising channel (a) complements offline advertising channels, (b) operates independently of offline advertising channels, or (c) substitutes for offline advertising channels.

The popular press and some of the marketing literature have emphasized the possibility that online and offline advertising channels may be complements. By “complements,” we mean the idea that offline marketing can increase the value of online advertising, and vice versa. For example, articles in the popular press (e.g. Elliott 2010, Frensley 2007) emphasize the importance of “synergies” between online and offline media. These articles argue that offline media generate interest, while online media engage people and satisfy that interest. This argument was emphasized in an industry white paper (DynamicLogic 2007) that demonstrates that campaigns that use multiple media tend to be more successful. Two academic studies (Lambert and Pregibon 2008 and Wilbur, Joo, and Zhu 2010) demonstrate that offline marketing communications can generate searches on search engines.

In contrast, most of the theoretical literature has assumed that online and offline channels are substitutes. Drawing on standard advertising models from economics and marketing, these papers assume that showing an ad has the same effect, regardless of the channel used. For example, Athey and Gans (2010) and Bergemann and Bonatti (2010) assume that firms substitute between online and offline advertising channels.

In a third view, regulators have argued that these channels are neither complements nor substitutes, but instead that online and offline advertising markets operate independently. The

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

Federal Trade Commission made no mention of the offline advertising market in its approval of the Google/DoubleClick merger (Federal Trade Commission 2008). The European Commission, in its Google/DoubleClick and Microsoft/Yahoo decisions, declared that, for antitrust purposes, “online advertising is a distinct market from offline advertising” (European Commission 2010, paragraph 61).

Overall, the internet “looms as a potential substitute or complement for all of the major categories of existing media” (Silk et al. (2001)). To date, there is little empirical evidence on the subject of whether it substitutes, complements or operates independently of offline media.²

This paper investigates whether there is substitution between online and offline channels and how this is mediated by a need by advertisers to target their communications. We use exogenous variation in the ability of advertisers to use one advertising sector to evaluate how it affects their willingness to pay for another advertising sector. Specifically, we exploit state-level variation in the ability of lawyers to solicit customers in cases related to recent personal injury or death.³ 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 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.

² The only exception we know of is Goldfarb and Tucker’s (2010a) study that documents the ability of online display advertising to circumvent local offline advertising bans for alcohol billboards.

³ 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.”

In locations with solicitation regulations, personal injury keywords cost advertisers between 5% and 7% 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 that advertisers substitute the online channel for the offline channel.

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 divorce law and misdemeanor offenses, 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 falsification 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 shows that other keyword categories (such as divorce law) do not have price premiums in states with solicitation restrictions.

In order to understand this substitution, we investigate in which markets the substitution is strongest. In search engine advertising, ads are displayed only when a customer uses a certain search term and the price paid depends on an auction for that specific search term. This means that search engine advertising is a particularly effective channel for targeted ads. We examine the role of targeting and find that online prices for personal injury keywords are highest when there

are a relatively small number of searches for a keyword. Prices for personal injury keywords were also higher for cities with smaller populations. In these cases, where the number of potential matches between advertiser and customer is smaller, regulations that shut down an offline targeting mechanism have a substantial effect. In contrast, when there are many potential clients, mass media advertising might be more effective and a reasonable alternative and there is less need for firms to substitute into search advertising.

There has been growing theoretical interest in studying the relationship between online and offline media through the lens of targeting (Athey and Gans 2010; Bergemann and Bonatti 2009). Our research contributes an improved empirical understanding of these relationships. Our research also extends a previous empirical literature that 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; and Goldfarb and Tucker (2010b) document that contextually targeted display ads are more effective in driving purchase intent. The emphasis on targeting effectiveness follows the theoretical literature in marketing (Iyer, Soberman, and Villas-Boas 2005; Gal-Or and Gal-Or 2005), that has modeled the effects on advertiser and consumer welfare implied by targeting.

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. 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 roles that offline channels and the targeting of keywords can have on the prices advertisers pay for search engine ads.

Overall, our results suggest that search engine advertising acts as a substitute for a traditional form of offline marketing communications. Furthermore, the result that this substitution is strongest in markets with fewer potential customers 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.⁴ 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 the top three positions in a certain city and the search volume associated with that price range.⁵ 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.

⁴ Our focus on paid search as the source of revenues for search engines means that we do not consider issues of non-paid search such as those discussed by Katona and Sarvary (2009).

⁵ 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.

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	12,271	0.156	0.397	0	3
Personal injury keyword	12,271	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 using less stable first-price auctions (Edelman, Ostrovsky, and Schwarz 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 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 regulations are overestimated using the Traffic Estimator Tool relative to all other keyword prices.

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 therefore confirmed 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 mostly 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.⁶

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,⁷ and (2) variation in rules regarding solicitation by personal injury lawyers across states. We use this variation in solicitation regulations to establish whether search

⁶ 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.

⁷ 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.

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.

In 1977, the Supreme Court deregulated legal advertising in *Bates v. the State Bar of Arizona*. This deregulation prompted a spate of empirical evaluation of legal services advertising by marketing scholars (Kotler and Connor 1977; Smith and Meyer 1980; Darden *et al.* 1981). However, the deregulation was not complete: Still today, some state bar regulations prohibit lawyers from directly contacting potential clients who have recently sustained an accident or injury.⁸ 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,

⁸ 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 5-4 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.”

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.⁹ 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.

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

⁹ 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).

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.¹⁰

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 the availability of an offline marketing communications technology (direct solicitation). Descriptive statistics of personal injury keyword prices across regulatory regimes suggest that the regulations have an effect: Personal injury keyword prices are 6% higher in states with solicitation regulation; by contrast, other keyword prices are a statistically insignificant 1% higher in states with solicitation regulation. This descriptive relationship is even more apparent when we look at similar types of keywords. Specifically, we compare the price of keywords for lawyers seeking clients who have committed a traffic offense, relative to the price of keywords for lawyers seeking clients who have been victim of a traffic accident. In states where there are solicitation restrictions, there is a highly significant \$3.50 (or 17%) premium (p -value=0.0005) for traffic accident keywords, relative to states where there is no solicitation restriction. However, when we look at traffic offenses, there is no significant difference.

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 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

¹⁰ The keywords, and whether they were categorized as personal injury keywords, are listed in the online appendix.

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 research, authors take the approach of using a prior time period not affected by the policy to control for geographical cross-sectional variation in customer behavior. These regulations were enacted before keyword search existed, so in this paper we use *other keywords* instead of a time series to control for cross-sectional variation in consumer behavior. As long as there is no other systematic reason why personal injury keywords should be priced differently 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.

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

We estimate equation [1] using a variety of specifications. In each specification, the sign of the coefficient on the interaction (β) tells us whether offline marketing communications restrictions affect online search advertising prices.

If the sign is negative, it suggests that these two forms of marketing communications are complements, in the sense that it means the ability to use the offline channel makes the online channel more valuable to the firm. Such synergies have been claimed in industry studies such as Dynamic Logic (2007), which found that when magazine ads were accompanied by an online campaign, they performed better than when they were run in isolation. The premise is that consumers need online advertising to be validated and extended by offline media, and, as shown

in the Dynamic Logic studies, this holds even when the target audience is reasonably narrow. Yang and Ghose (2010) label a similar type of positive interdependence between sponsored and organic search listings “complementary.”

If the sign on the interaction is positive, it suggests that lawyers are willing to pay more for online advertising if they cannot use offline advertising. That is, when state bar regulation makes it harder to use targeted forms of direct response mail that offer representation to personal injury victims, lawyers are willing to pay more to ensure their web ad is posted next to search results. The fact that lawyers are willing to bid more for one form of advertising when the other is not available implies substitutability between the two media.

Besides the simple definitions above, “substitutability” may be defined as decreasing returns to combining two separate inputs (or, in our setting, combining two separate types of advertising media.) The extent to which the sign of the interaction coefficient can illuminate whether there are decreasing or increasing returns depends crucially on whether lawyers have alternatives to advertising to obtain clients.

If lawyers have to find a certain number of clients to keep their billable hours up and their schedules full, if advertising is the only way to find them, and if the offline channel becomes unavailable, then lawyers will spend more money in the online channel even if there are increasing returns to combining the online and offline channels.¹¹ However, lawyers do have other ways of finding legal services clients. Lawyers with more clients than they can handle, or with too few clients, use a secondary market for legal services client leads. Firms specializing in legal service referrals broker these leads, dealing predominantly in leads recruited from late-night and cable television spots and large Yellow Pages ads (Malan 2009). Therefore, if offline

¹¹ This intuition is formalized in Athey and Gans (2010), who present an extension that shows how changing capacity constraints affect advertiser responses to the availability of targeted media.

advertising restrictions destroyed the potential for synergies between the online and offline channels, lawyers would have an alternative through the secondary market to spending more on the now less productive online channel. Since individual lawyers do not have to use advertising to identify their quota of clients, we argue that non-increasing returns to combining the two media is a compelling interpretation of a positive price coefficient.

Column 1 of Table 3 displays the results of our base specification. The dependent variable is the log of the estimated price to allow interpretation of the coefficients as reflecting a proportional change. 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 5.2% increase in the price of a personal injury keyword, judging by the midpoint of the range given by Google's Traffic Estimator Tool. When offline marketing communications are unavailable, firms appear to switch to search engine advertising.

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) and (3) of Table 3 show a similar pattern of positive and significant results for the lower and upper limits of cost per click. Columns (4) to (6) suggest the same pattern using linear (not-logged) values for the CPC.

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 higher quality personal injury lawyers relative to states that do not; and that in those states, the higher quality personal injury lawyers have a higher success rate at prosecuting cases and consequently are willing to pay more for advertising.

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

Dependent variable	(1) Logged Midpoint CPC	(2) Logged Max CPC	(3) Logged Min CPC	(4) Linear Midpoint CPC	(5) Linear Max CPC	(6) Linear Min CPC
Personal injury keyword <i>and</i> Rule restricting solicitation	0.052** (0.021)	0.061*** (0.020)	0.136** (0.062)	1.013*** (0.298)	1.112*** (0.386)	1.012*** (0.277)
Observations	12271	12271	26964	12264	12264	21299
R^2	0.81	0.85	0.58	0.89	0.92	0.77

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

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 other categories of keywords (e.g. divorce, misdemeanors) do not display a price premium in the states with solicitation regulations. 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, because the main effect is captured by the fixed effects, most of the variables enter as interactions with the personal injury keyword dummy. This section includes controls with a conservative approach in the sense that we have included several variables which might affect the main results simply to identify robustness. For the most part, we do not view the coefficients on these results as having an interesting interpretation.

Table 5 shows that, with these controls, the interaction of Personal Injury Keyword and Rule Restricting Solicitation remains significant within a narrow range.¹² Columns (1) to (3) add controls for market size (search volume, wealth). These controls address alternative explanations for our results based on market size and wealth (for example, richer places are more likely to have ambulance-chaser regulations and also to attract more personal injury lawyers). Columns (4) and (5) of Table 5 add controls for differences in the level of legal activity across local legal markets (the number of civil cases per capita 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 (6) and (7) 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”

¹² 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).

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 tend to be in personal injury cases. This addresses alternate explanations, such as a theory where solicitation regulations are enacted in states where firms fear 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.

Columns (8) and (9) of Table 5 add the controls for the estimated number of bidders in the keyword auction. The number of bidders is a potentially endogenous measure of market size as it is likely to be related to unobserved market characteristics and the coefficients should not be interpreted.¹³ 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. Column (10) shows robustness to a linear, non-logged, specification of the dependent variable.

¹³ We have also checked that our results in the remainder of the paper are not affected by the inclusion of this potentially endogenous variable. The qualitative results do not change and the coefficients of interest change very little if this variable is excluded.

Table 4: Control Variable Description

Variable label	Variable description	Data source	Mean	Standard deviation
Search volume per capita	Search volume predicted for that keyword in that city divided by city population	Google	0.17	0.84
GSP	Gross state product (in \$100,000s) per capita	US Bureau of Economic Analysis	0.40	0.06
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 (in \$100,000s)	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.

While the main focus of Table 5 is to show the robustness of the core result, the coefficients on some of the controls are interesting. Personal injury keyword prices are particularly high in wealthy (row 4) places. Perhaps surprisingly, personal injury keyword prices are lower in places with a relatively high number of civil cases (row 5) and a relatively high level for average medical malpractice payouts (row 8). Finally, having more bidders is associated with higher keyword prices (row 10), perhaps due to a more competitive keyword auction.

Table 5: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Logged	Logged	Logged	Logged	Logged	Logged	Logged	Logged	Logged	Linear
(1) Personal injury keyword <i>and</i> Rule restricting solicitation	0.052** (0.021)	0.052** (0.021)	0.054** (0.021)	0.061** (0.024)	0.064** (0.025)	0.063*** (0.024)	0.069*** (0.026)	0.069*** (0.025)	0.069*** (0.025)	1.346*** (0.369)
(2) Search volume per capita	0.017*** (0.006)	0.017*** (0.006)	0.017*** (0.006)	0.017*** (0.006)	0.017*** (0.006)	0.017*** (0.006)	0.017*** (0.006)	0.016*** (0.006)	0.017*** (0.006)	0.017 (0.054)
(3) Personal injury keyword × Search volume per capita		-0.016 (0.041)	-0.025 (0.040)	-0.027 (0.040)	-0.025 (0.039)	-0.025 (0.039)	-0.026 (0.039)	-0.026 (0.039)	-0.027 (0.038)	1.730*** (0.576)
(4) Personal injury keyword × GSP			0.353*** (0.123)	0.456*** (0.161)	0.465*** (0.163)	0.465*** (0.165)	0.590*** (0.203)	0.590*** (0.205)	0.587*** (0.205)	12.112*** (3.115)
(5) Personal injury keyword × CivilCasestoPop				-0.720** (0.305)	-0.686** (0.300)	-0.687** (0.310)	-0.613** (0.291)	-0.612** (0.293)	-0.608** (0.293)	-11.458*** (3.843)
(6) Personal injury keyword × MSALawOfficestoPop					-0.002 (0.001)	-0.002 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.027 (0.024)
(7) Personal injury keyword * JudicialHellHole						-0.001 (0.033)	-0.011 (0.035)	-0.011 (0.036)	-0.011 (0.036)	0.608 (0.566)
(8) Personal injury keyword × AvgMalpracticePayout							-0.023*** (0.008)	-0.023*** (0.008)	-0.023*** (0.008)	-0.394*** (0.122)
(9) Personal injury keyword × ManyBidders								-0.003 (0.025)	-0.054* (0.032)	-0.185 (0.497)
(10) ManyBidders									0.051** (0.021)	0.360* (0.183)
(11) Observations	12264	12264	12264	12114	12048	12048	12048	12048	12048	12055
(12) R ²	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.81

Dependent variable: midpoint of the keyword's estimated cost per click, logged in columns 1-9 and linear in column 10. 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Although adding these controls does not fully address the endogeneity of the solicitation rules, the robustness of our results to controls for search volume, 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. Furthermore, the result that these added controls raise the estimated price premium for personal injury keywords in states with solicitation restrictions suggests that the potential misspecification due to location-level heterogeneity may have biased our Table 3 results downward.

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 two such groups in lawyers who specialize in divorces and lawyers who specialize in misdemeanors (such as traffic violations and DUI).¹⁴

Table 6: Varying the Control Group

	(1)	(2)	(3)	(4)	(5)	(6)
Control Group	Logged Divorce keywords as controls	Logged Only misdemeanor offenses as controls	Logged Diluted definition	Linear Divorce keywords as controls	Linear Only misdemeanor offenses as controls	Linear Diluted definition
Personal injury keyword <i>and</i> rule restricting solicitation	0.082*** (0.029)	0.054* (0.029)	0.059** (0.024)	1.708*** (0.417)	1.005*** (0.354)	1.158*** (0.343)
Observations	3375	3808	12048	3376	3809	12055
R^2	0.76	0.68	0.89	0.71	0.66	0.81

Dependent variable: midpoint of the keyword's estimated cost per click, logged in columns 1-3 and linear in columns 4-6. 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 and the full set of controls from table 5. Full set of coefficients reported in the online appendix. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We include an additional definition of the control group to check the general robustness of our specification. In column (3) 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). Columns (4) to (6) show robustness to a linear specification of the dependent variable.

¹⁴ Divorce lawyers have 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). 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).

3.3 Falsification Checks

We also checked the robustness of our results by conducting two falsification exercises. The first falsification exercise examines 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 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). Column (1) of Table 7 combine all states. Column (2) shows results that include only Arkansas

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.

as a regulated state. Column (3) of Table 7 looks at all states except Arkansas. Columns (4) to (6) show robustness to a linear specification. The lack of a significant 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)	(5)	(6)
	Logged	Logged	Logged	Linear	Linear	Linear
	All states	Arkansas and states without regulations	All states except Arkansas	All states	Arkansas and states without regulations	All states except Arkansas
Covered wrongful death keyword <i>and</i> law restricting solicitation	0.095*** (0.031)	0.625*** (0.086)	0.088*** (0.030)	1.709*** (0.459)	7.226*** (1.286)	1.619*** (0.435)
Covered personal injury-specific keyword (not death) <i>and</i> law restricting solicitation	0.035* (0.020)		0.032* (0.019)	0.868*** (0.289)		0.839*** (0.284)
Not covered personal injury- specific keyword (not death) <i>and</i> law restricting solicitation	-0.013 (0.068)	-0.141 (0.091)		-0.053 (1.342)	-1.820 (1.631)	
Observations	12048	8039	11890	12055	8045	11897
R^2	0.89	0.88	0.89	0.82	0.79	0.81

Dependent variable: midpoint of the keyword's estimated cost per click, logged in columns 1-3 and linear in columns 4-6. 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 and the full set of controls from table 5. Full set of coefficients reported in the online appendix. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Falsification Check on Other Keyword Categories

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Logged	Logged	Logged	Logged	Logged	Linear	Linear	Linear	Linear	Linear
Personal injury keyword <i>and</i> law restricting solicitation	0.059** (0.027)	0.068*** (0.025)	0.068*** (0.026)	0.068*** (0.026)	0.050* (0.029)	1.418*** (0.381)	1.336*** (0.369)	1.373*** (0.375)	1.352*** (0.372)	1.454*** (0.392)
Civil Case Keyword <i>and</i> law restricting solicitation	-0.018 (0.019)				-0.025 (0.019)	0.176 (0.154)				0.202 (0.137)
Divorce Law keyword <i>and</i> law restricting solicitation		-0.0004 (0.018)			-0.023 (0.018)		-0.092 (0.138)			0.003 (0.089)
Felony Crime Keyword <i>and</i> law restricting solicitation			-0.010 (0.018)		-0.032 (0.021)			0.131 (0.200)		0.146 (0.214)
Misdemeanor keyword <i>and</i> law restricting solicitation				-0.006 (0.026)	-0.006 (0.025)				-0.035 (0.265)	-0.124 (0.299)
Observations	12048	12048	12048	12048	12048	12055	12055	12055	12055	12055
R-Squared	0.89	0.89	0.89	0.89	0.89	0.82	0.82	0.82	0.82	0.81

Dependent variable: midpoint of the keyword's estimated cost per click, logged in columns 1-5 and linear in columns 6-10. 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 and the full set of controls from table 5. In columns (1) to (4) and (6) to (9) the controls are interacted with the alternative keyword group labeled in rows 2-5. Full set of coefficients reported in the online appendix. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Our second falsification check addresses the concern that our results are not unique to personal injury keyword categories, and that, in our current specification, our location and keyword fixed effects force the same estimated location-specific price differences on all non-personal injury keywords. Therefore, in Table 8, we allow four other keyword categories (civil case keywords, divorce law keywords, felony crime keywords, and misdemeanor keywords) to have a different estimated coefficient in states with the solicitation restrictions. Columns (1) to (4) present them separately and column (5) presents them estimated together. Columns (6) through (10) show robustness to a linear specification. The other types of keywords do not have a statistically significant price premium in states with solicitation restrictions. Consistent with our interpretation of the results as evidence of substitution between offline and online marketing communications channels, our results are specific to personal injury keywords.

4. Substitution towards online advertising is strongest when there are fewer potential clients

So far, we have documented that a ban on mailed solicitations, an offline marketing communications channel, raises the value of search engine advertising to firms. In other words, we have shown that the online channel substitutes for the offline channel. In this section, we further our understanding of this channel substitution by demonstrating that the observed substitution is much stronger in markets where there are fewer potential customers.

Specifically, in Table 9, we stratify our results by population and by the number of searches for a particular keyword. The first row presents the logged specification. We find that substitution is stronger in places with lower populations (under 1 million) and for keywords with

fewer searches (below average).¹⁶ In the linear specification, the population results are robust, though we see no substantive difference by number of searches by keyword.

We interpret this as suggesting that offline direct marketing affects online prices most when there are fewer matches to be made. When the target customers are hard to reach, mass advertising may not be cost-effective. In contrast, when the target customers are plentiful, firms can substitute into mass-media advertising, such as billboards soliciting car accident victims along highways. Search engine ads are therefore particularly close substitutes for offline direct marketing when customers are sparse and consequently difficult to reach cost-effectively via the mass media.¹⁷ Search engine ads appear to play an efficiency-enhancing role, by allowing firms to send informative ads to customers that would be otherwise hard to reach.

Table 9: Stratification by Market Size

	(1) <1 Million Pop	(2) >1 Million Pop	(3) Below mean Search Volume	(4) Above mean Search volume
LOGGED				
Personal injury keyword <i>and</i> law restricting solicitation	0.106** (0.045)	0.034** (0.014)	0.072*** (0.025)	0.013 (0.023)
Observations	6624	5424	9622	2426
R-Squared	0.90	0.90	0.86	0.96
LINEAR				
Personal injury keyword <i>and</i> law restricting solicitation	1.955*** (0.636)	0.401* (0.212)	1.155*** (0.362)	1.322*** (0.102)
Observations	6629	5426	9629	2426
R-Squared	0.80	0.86	0.80	0.95

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 and the full set of controls from table 5. Full set of coefficients reported in the online appendix. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

¹⁶ Given that most keywords are estimated at zero searches per day, there is no difference between splitting at average searches and splitting by whether there are zero or positive searches per day.

¹⁷ 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.

5. Conclusion

We show that search advertising prices are 5 to 7 percent higher when offline solicitation by trial lawyers is banned. Our econometric specification and controls suggest a causal relationship. Therefore, in this setting, advertisers are willing to substitute between online and offline marketing communications channels.

The relationship between solicitation restrictions and the price of personal injury keyword advertising is much stronger when the number of potential customers is small. For smaller cities and for keywords with relatively few searches, the effect of the solicitation restrictions on prices is substantially higher. 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. In these cases, search engine advertising is a particularly close substitute for offline direct mail 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.

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. Therefore, while search engines are often accused of gathering private information and violating secrecy-related privacy concerns,¹⁸ they might also play a useful role in overcoming privacy concerns related to intrusive behavior.

¹⁸ For example, Google is under investigation in Germany for contravening privacy law restrictions on the retention of IP addresses (Jakobs 2009.)

There are several 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 substitution using variation in state regulations of highly targeted advertising, 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 look at a broader set of contexts for substitution and examine how targeting mediates the relationship between online and offline marketing communications in different settings.

Notwithstanding these limitations, we believe our findings demonstrate substitution between offline marketing communications and search engine advertising with an important mediating role for targeting. 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- and welfare-improving role for search engine advertising that enables firms to send informative ads to customers who would otherwise be hard to reach.

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