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# Search Engine Advertising: Pricing Ads to Context


## Abstract

Each search term put into a search engine produces a separate set of results. Correspondingly, each of the sets of ads displayed alongside these results is priced using a separate auction. There is growing debate whether this marketing strategy merely makes advertising more informative, or whether using context to price also effectively price discriminates. To inform this debate, we examine advertising prices paid by lawyers for 174 Google search terms in 195 locations and exploit a natural experiment in "ambulance-chaser" regulations across states. Where state laws impose limits on lawyers' contingency fees limits, the relative price of advertising is $2.27 lower. This suggests that context-based pricing allows prices to reflect heterogeneity in the profitability of customer leads. When lawyers cannot contact a client by mail, the relative price per ad click is $0.93 higher. This suggests that context-based pricing allows prices to reflect heterogeneity in advertisers' other advertising options, even within a given local market. This last result emphasizes that search engine's pricing clout depends on the extent of competition, both online and offline.



Keywords: Search Engines, Advertising Prices, Two-Sided Networks, E-commerce, Internet Marketing

## 1. Introduction

In 1998 Goto.com introduced[1] two novel features to search advertising markets that had not been tried before in other advertising markets: (1) The use of electronic auctions and (2) the ability to provide and price advertisements based on search terms or "keywords". The practical implications are as follows. A personal injury lawyer and an immigration lawyer decide to advertise their services. Using normal media channels, like newspapers, magazines, Yellow Pages or a banner ad on a website, they would pay the same price, given the advertisement's physical size, placement and the audience size and demographics. If they used Google, though, which uses a similar system to the one pioneered by Goto.com, it would be a different story. The personal injury lawyer, after placing a bid online, would pay on average $26.18 every time someone clicked on her ad alongside a search for "personal injury lawyer". However, the immigration lawyer using Google would have to pay on average only $7.48 per click for the same sized ad, displayed alongside a search for "immigration lawyer".

So far, the academic literature on search-engine ad pricing has focused on developing models of quality-adjusted second-price auctions for multiple advertising slots. Theoretically these auctions could be run on many bases, not just which results are displayed with the ad. These might include advertiser characteristics, the timing of the ad, estimated demographics, or past-customer behavior. Therefore, prior research does not illuminate the effects of running auctions by ad context. In recent Senate testimony, Google has argued that the main motivation behind separate sets of ads (and ad prices) for separate search terms is to enhance the experience for the customer, by increasing the usefulness of its ads relative to the search term entered.

[1]Goto.com was renamed Overture in 2001 and purchased by Yahoo in 2003. Prior to this time, search engine ads were priced by impressions and demographics.

> *"Simply put, advertising is information, and relevant advertising is information that is useful to consumers. The advertising we deliver to our users complements the natural search results that we provide, because our users are often searching for products and services that our advertisers offer."*
>
> David Drummond, Google Senior VP for Corporate Development, before the Senate Judiciary Committee [September 27, 2007]

We ask in this paper whether there are other motivations for context-based ad pricing than mentioned in this passage. Namely, do search engines use "context-based" ad pricing not only to deliver a better user experience but also directly to extract higher rents from advertisers through finer price discrimination?

To explore whether context-based pricing facilitates price discrimination, we empirically evaluate whether context-based prices reflect heterogeneity in the profitability of customer leads and availability of outside options. The latter is of interest because the use of auctions has clouded the issue of whether outside advertising options matter. For example, a recent Economist article claimed that "the price that Google charges its advertisers is set by auction, so its monopolistic clout is limited" (Economist 2007). In the light of this confusion, a second contribution of our paper is to document how the extent of media platform competition affects the final price of search ads. Ultimately, our results emphasize that media platform market power is not decreased by the use of auctions. This is a pressing question given proposed consolidation in media platform markets: antitrust authorities need to understand how much different media platforms are able to compete.

However, we face the identification challenge that advertising demand (variation in profitability customer leads) and advertising market structure (the availability of outside advertising options) are endogenous to underlying marketing conditions. This means they are confounded. One empirical approach would be to conduct an experiment, where we randomly

make some customers unreachable by alternative advertising platforms; make other customers less profitable; and evaluate whether context-based ad prices reflect these different conditions. In the absence of such a randomized field experiment, we identified a similar "natural experiment" in advertising for lawyer services, a sector that has annual revenues of over $40 billion.

This natural experiment exploits differences in how states regulate lawyers in personal injury and wrongful death suits in order to dissuade unseemly "ambulance-chaser" behavior. We exploit differences in state regulations over contingency fee limits and State Bar solicitation regulations that limit whether lawyers can contact clients by mail.[2] Solicitation regulations decrease the availability of alternative advertising venues for lawyers, while contingency fee limits affect the profitability of client leads. To investigate the effect of this exogenous variation in competition and advertising demand, we use Google's estimates of the price range for ads and a difference-in-difference identification strategy. The prices are associated with 174 different searches for various legal service "keywords" in 195 regional city markets. We regress a keyword's estimated price per click on fixed effects for each location and keyword, and an indicator variable for whether the keyword is affected by state regulations.

We find that prices for personal injury keywords in states with contingency fee limits are $2.27 (roughly 17%) lower than other unaffected keywords in that state, relative to price premiums for personal injury keywords in unregulated states. This implies that context-based ad pricing reflects differences in the profitability of customer leads.

We find that in locations with solicitation regulations, injury keywords cost advertisers an extra $0.93 (roughly 7%) relative to the price of other keywords (such as "tax lawyer") in that state, compared with the price premium of personal injury keywords in non-regulated states. This

[2] It is almost always forbidden for lawyers to contact such potential clients in person, including through telephone or electronic communication.

suggests that when advertisers cannot reach customers through alternative advertising platforms, context-based ad pricing allows search engines to charge more. This implied substitutability of online and offline advertising suggests that when policy makers or market analysts seek to define advertising markets, they should consider both online and offline channels in their market definitions.

These results inform the growing debate on the role of context-based ad pricing, by emphasizing that while it may make advertising more useful to users, it also allows media platforms to extract high rents from advertisers if there are fewer outside advertising options or customer leads are more profitable. This suggests that despite the use of auctions, search engines do have monopolistic pricing clout. The sensitivity pricing to offline media channels, however, suggests that when evaluating proposed media platform consolidation, the market definitions for this industry should consider both offline and online media channels as substitutes.

## 2. Related Literature

Our paper examines the extent to which context-based ad pricing in media platforms permits price discrimination. We build on four distinct literatures: (1) two-sided advertising markets, (2) online advertising, (3) online/offline substitution, and (4) marketing of legal services.

Previous research on two-sided media platforms, such as search engines, has modeled the use of content to attract customers and consequently advertisers (Anderson and Gabszewicz 2005; Xie and Chen 2007). However, this literature focuses on the use of content to entice customers when there is a fixed advertising price, rather than exploring the possibility that

content could also be used to price-discriminate between advertisers.[3] The empirical literature has echoed this focus when studying traditional media-platforms. Wilbur (2007) has shown how the effect of context (or program type) on television advertising prices is dwarfed by the effects of demographics and the size of the audience reached. Busse and Rysman (2005) document how Yellow Pages use ad size rather than ad context as a price discrimination tool. By contrast, this paper emphasizes that content is not only a draw for consumers, but can also be used as a way of implementing price discrimination for advertisers.

Our empirical focus on the use of content to discriminate between different advertisers with different willingness to pay illuminates a nascent theoretical literature on the potential benefits of "targeting" advertising. Work by Iyer, Soberman, and Villas-Boas (2005) demonstrates the theoretical advantages that such targeting has for firms, while Gal-Or and Gal-Or (2005) use the example of customized television advertising to show that better targeting of advertisements increases customer welfare. Chen and He (2006) have extended this targeting literature to paid search.

Our emphasis on search engines using content as a price-segmentation tool contrasts with the majority of the literature on search engine ad pricing, that focuses on search engines' use of auctions.[4] Pioneering work by Edelman, Ostrovsky, and Schwarz (2007) showed that limiting the number of advertising slots allows search engines to extract higher rents in keyword auctions. This focus on generalizing the second-price auction to a multiple-slot format, both in theory and empirical literature such as (e.g. Ganchev, et al. 2007) means the authors take the

[3] The consequences of such inflexible pricing policies are set out by Baye and Morgan (2001). They show that when a media platform sets a fixed advertising fee, this fee will exceed the socially optimal level and many potential advertisers will opt out.

[4] An exception is Wilbur and Zhu's (2007) work on click-fraud.

decision to hold a separate auction for each keyword as exogenous.[5] We argue that the use of auctions to price *context,* rather than traditional advertising variables such as demographics or ad length, is also an important innovation in marketing.

The empirical literature on search advertising in marketing has focused on the performance of different types of keywords for search advertising. For example, Rutz and Bucklin (2007) and Ghose and Yang (2007) have shown the effects of different keywords on performance and cross-selling opportunities. The rest of the empirical literature on online advertising has focused on banner ads and email marketing (such as Manchanda, et al. 2006; Chatterjee, Hoffman and Novak 2003; and Ansari and Mela 2003), perhaps because these predate keyword advertising.[6] Ansari and Mela (2003) find, consistent with Google's Senate testimony, that targeting improves matches and therefore makes consumers and firms better off. While this may be true, we find evidence that targeting also allows Google to more effectively price discriminate.

We also add to a growing literature on the relationship between offline and online options and marketing outcomes (Jank and Kannan 2006). Forman, Ghose, and Goldfarb (2007) find that local retail competition affects online purchasing. Anderson et al (2007) show how high sales tax rates lead customers to substitute between remote retail channels and the internet. We add to this literature by showing that the benefits of "going online" vary not only for consumers, but also for firms making advertising investments. We show that the benefits of advertising through the online channel depend on local conditions that affect the profitability of a lead and the level of competition in marketing communications.

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[6] The first banner advertisement (for Zima alcoholic beverage) appeared on Wired Magazine's Hotwired website in 1994. While OpenText briefly experimented with something like search advertising in 1996, it was not successfully implemented until Goto.com applied it in 1998. Prior to the establishment of auctions as the way to price keywords, Yahoo charged a fixed rate for banner advertisements placed near popular keywords.

Finally, our work is related to an older but substantial marketing literature on legal services advertising (Smith and Meyer 1980, Kotler and Connor 1977, Darden, Darden and Kiser 1981). This literature was inspired by the deregulation of legal services advertising in 1977 and examined the consequences from both firm and consumer perspectives of the introduction of advertising and marketing by lawyers. We follow in this tradition by studying the relationship between regulation and lawyer advertising prices.

## 3. Data on Advertising Prices for Lawyer Services

Since 2002, Google and Yahoo have sold keywords using a second-price sealed bid auction as opposed to the less stable first-price auction (Edelman, Ostrovsky and Schwarz 2007). However, the nature of the second-price auction obscures how bids translate to prices. An advertiser places a bid based on its maximum willingness to pay for an advertisement to appear next to a specific search term for a specific geographical location. Google then bills an amount that is 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 both 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.[7]

Google provides these estimates to potential clients who use their "Traffic Estimator Tool". This traffic estimator provides (when there are enough data points) a range of prices for what other advertisers have paid recently for an advertisement being in positions 1-3 in a certain

[7] Google accounts for two-thirds of the search market (October, 2007).

location. Therefore, in using data from the Traffic Estimator Tool, we use the exact information advertisers use in setting their bid prices.

Our data come from market research conducted on behalf of a new lawyer portal website. This research examined 33,930 keyword-specific ad prices using Google's Traffic Estimator Tool. These projections were for 174 keywords for 195 geographic areas defined by Google to closely resemble (consolidated) metropolitan statistical areas. In order to use our natural experiment of state-level restrictions, we exclude metropolitan statistical areas that cross state lines, like Burlington, VT – Plattsburg, NY and New Bedford, MA – Providence, RI. Our data include Google's estimate of the upper and lower range for the price per click of appearing next to a keyword string in positions 1-3. Appendix Table 1 provides descriptive statistics for the data used in the study. Appendix Table 2 provides a complete list of the keywords used.

There is a wide range in the average price per click for the different keywords and different types of keywords. The lowest priced specialty legal terms are "Money Laundering Attorney" and "Food Poisoning Attorney", at a mean of $0.56 and $0.68 per click respectively across locations.[8] The highest priced term is "Aviation Accident Attorney" at an average of $36.62. Though it is clear that this represents a departure from other media where attorneys would all pay the same price for the same space, it is not clear whether these differences are being driven by sensitivity to the profitability of customer leads or by differences in market competition or something else.

Prices for a given keyword can vary considerably across cities. Abilene-Sweetwater, TX, has the most expensive keyword in the data at $80.17 for "mesothelioma attorney" (mesothelioma is an asbestos-related cancer). In contrast, the same keyword string costs just

[8] Keyword prices quoted in this section are based on Google's upper estimate of appearing in positions 1-3.

$14.33 in Binghamton, NY. Without empirical analysis, however, it is difficult to know to what extent the high price in Abilene-Sweetwater reflects a lack of competition from other media platforms, or the average likelihood in Texas relative to New York of obtaining the $2 million payout for a typical mesothelioma lawsuit.[9]

One challenge of using these price data is that Google gives a price range, but not an indication of the distribution of prices paid between these lower and upper cutoffs. Because of this, we report results separately for the upper bound and the lower bound of the price estimate. We also face a missing data challenge, in that Google reports these ranges only when they have enough historical data. In section 5 we discuss in detail how we address these missing data.

## 4. Variation in Restrictions on Lawyer Behavior

Trial lawyers earned $40 billion in 2004, an amount that is over 50 percent higher than Microsoft or Intel and twice that of Coca-Cola (National Review 2004). The size of this market makes studying advertising strategies in this industry independently important. However, for our purposes there are two other attractive features of this industry: Differences in state-level bar exams keep markets local and there is variation in regulation across states. We use variation in two distinct regulations to establish whether context-based ad pricing allows search engines to profit from heterogeneity in what other media channels advertisers can use and in the profitability of customer leads. Each regulation gives us a natural experiment with a treatment group of locations that are 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

[9] Source: www.mesothel.com

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.

Law firms have only been allowed to advertise nationwide since 1977, when the Supreme Court ruled to allow legal advertising in Bates v. the State Bar of Arizona. This case brought to an end a state bar association tradition that it was not seemly for lawyers to advertise their services in newspapers, on television, or through other channels. This deregulation prompted a spate of empirical evaluation by marketing scholars (Smith and Meyer 1980, Kotler and Connor 1977, Darden, Darden and Kiser 1981) on legal service advertising. However, the notion that there are some types of marketing communications that demean the status of the law persists in local state bar regulations. In particular, some state bars prohibit lawyers from writing to potential clients who have recently sustained an accident or injury.

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 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 1 records all instances (as of April 2007) where a state bar prohibited written communication to potential clients. There is a little variation over how long the states prohibited contact (the mode is 30 days), but the regulations are similar. There was no statistically significant relationship between the enactment of a law and the number of lawyers per dollar of gross state product, the number of civil suits per capita, state population, or state GDP (Appendix Table 3).

**Table 1: Bar regulations prohibiting contact with clients**

| State | Personal injury laws/rules |
|---|---|
| **Alabama** | No written communication allowed 30 days for personal injury or wrongful death |
| **Arizona** | No written communication allowed 30 days for personal injury or wrongful death |
| **Arkansas** | No written communication allowed 30 days for wrongful death |
| **Colorado** | No written communication allowed 30 days for personal injury or death |
| **Connecticut** | No written communication allowed 40 days for personal injury or death |
| **Florida** | No written communication allowed 30 days for personal injury or wrongful death |
| **Georgia** | No written communication allowed 30 days for personal injury or wrongful death |
| **Hawaii** | No written communication allowed 30 days for personal injury or wrongful death |
| **Louisiana** | No written communication allowed 30 days for personal injury or wrongful death |
| **Missouri** | No written communication allowed 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 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 30 days for personal injury or wrongful death |
| **Tennessee** | No written communication allowed 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 |

State bar associations are not the only authority regulating personal injury lawyers. Reports that America's tort system costs up to 2 percent of GDP, and anecdotal evidence that excessive litigation has driven up insurance costs, has led some states to impose contingency fee limits. [10] A contingency fee is a fee payable only in the case of a favorable result. Lawyers often take cases on a contingency fee basis, betting that there will be a large enough payout to make it worth their while. This fee structure enables poor clients to afford a lawyer. However, lawyers often demand large proportions of the payouts that the courts award in order to compensate themselves for the risk. Table 2 displays the contingency fee limits across states based on data from the Pacific Research Institute's "U.S. Tort Liability Index". While there is substantial variation in the laws' texts, all the laws ultimately limit how profitable it is to represent a personal injury client. Since these laws vary more than the solicitation laws in substance, we also

[10] The actual costs of the tort system are highly disputed. See the article "Is the Tort System Costing the United States $865 Billion a Year?" Richard Posner, Note, Chicago Law School, 2007

tried specifications that reflected the Pacific Research Institute's ranking of the severity of these contingency laws, with similar results. We found no statistically significant relationship between a law's enactment and the number of lawyers per dollar gross state product, the number of civil suits per capita, or the state's population, though there was a statistically significant positive relationship between contingency fee limits and gross state product per capita (Appendix Table 3). We control for this difference in states that have contingency fee regulation by focusing on the differences in prices between keywords that are likely to be affected by the legislation and a baseline of unaffected keywords in that state.

**Table 2: State Laws on Contingency Fees**
***Source: Pacific Research Institute***

| State | Law |
|---|---|
| **Alaska** | Requires that contingent fees be calculated exclusive of punitive damages. [Alaska Stat. § 9.60.080.] |
| **Illinois** | Limits contingent fees to 33.3% of the first $150,000 recovered, 25% of the next $850,000 recovered, and 20% of any amount recovered over $1 million. [735 Ill. Comp. Stat Ann. § 5/2 –1114.] |
| **Maine** | Limits contingent fees in professional liability cases to 33.3% of the first $100,000 recovered, 25% of the next $100,000 recovered, and 20% of any amount recovered over $2 million. Permits a judge to allow fees in excess of these amounts in special circumstances. [Me. Rev. Stat. Ann. tit. 24 § 2961.] |
| **Nebraska** | Allows a court to review contingent fees in medical and professional liability cases. [Neb Stat. § 44-2834.] |
| **Oklahoma** | Limits contingent fees to 50% of a plaintiff's recovery. [Okla. Stat. Ann. tit.5, § 7.] |
| **Wisconsin** | Limits contingent fees to 1/3 of the first $1 million recovered, 25% of the first $1 million recovered if liability is stipulated within 180 days of filing of the original complaint and not within 60 days of first day of trial, and 20% for amounts exceeding $1 million recovered. Allows a judge to exceed these amounts in exceptional circumstances. [Wisc. Stat. Ann. § 655.013.] |

Personal injury keywords can be objectively identified because bar associations uses 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, and is taken to cover 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.[11] There are, however, a few cases 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. We tried including and excluding these "combined" civil cases, and achieved qualitatively similar results.

## 5. Estimation Strategy and Results

Using data on the prices of keywords across cities, we examine the responsiveness of keyword prices to variation in local conditions. Figures 1 and 2 show that there are systematic differences in average pricing of keywords across states. Furthermore, descriptive statistics of keyword prices across regulatory regimes are suggestive of the regulations having an effect: keyword prices are 96 cents lower in states with contingency fee regulation and 28 cents higher in states with solicitation regulation. These differences may, however, be a result of unobservable differences in willingness to pay across keywords and locations. To control for these unobservable differences, we include a series of 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 differences in numbers of lawyers, wealth, 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*

[11] The keywords, and whether they were categorized as personal injury keywords, are listed in Appendix Table 2.

that occur because states that enact personal injury regulation are different from states that don't; this is known as a "differences in differences" approach.[12] As long as there is no other systematic reason why personal injury keywords should be differently priced to non-personal injury keywords in states with regulation, we can interpret the interactions $\alpha$ and $\beta$ as measuring the causal effect of the regulations on prices.

$$
\begin{aligned}
&Cost\ per\ Click_{kl} \\
&\quad = \alpha(PersonalInjuryWord_k)X\ (Solicitation\ Restricted_l) \\
&\quad + \beta(PersonalInjuryWord_k)X(ContingencyFeeLimit_l) \\
&\quad + \text{Keyword}_k + City_l + \varepsilon_{kl}
\end{aligned}
\qquad [1]
$$

We estimate equation [1] using a variety of distributional and specification assumptions. Table 3 displays results for our main specification. The estimates for the interactions suggest that both solicitation regulations and contingency fee limits affect the prices that lawyers pay for personal injury search terms.

[12] This use of differences in differences is a similar idea to the specifications used by Chevalier and Mayzlin (2006) in their study of online book reviews and Busse, Risso and Zettelmeyer (2006) in their study of pass-through of auto manufacturer promotions.

**Table 3: Main Results**

| | Dependent variable is price per click of ranking first | | Dependent variable is price per click of ranking third | |
|---|---|---|---|---|
| | Robust standard errors | Clustered standard errors[13] | Robust standard errors | Clustered standard errors |
| Personal injury keyword *and* Law restricting solicitation | 0.928*** | 0.928** | 0.731** | 0.731*** |
| | (0.28) | (0.36) | (0.29) | (0.26) |
| Personal injury keyword *and* Law restricting contingency fees | -2.273*** | -2.273*** | -1.860*** | -1.860*** |
| | (0.51) | (0.56) | (0.48) | (0.49) |
| Observations | 13455 | 13455 | 13455 | 13455 |
| R-squared | 0.84 | 0.84 | 0.64 | 0.64 |

Standard errors in parentheses
All regressions include a full set of fixed effects for each city and each keyword.
*** p<0.01, ** p<0.05, * p<0.1

The presence of a solicitation regulation is associated with a $0.93 increase in the upper price for personal injury keyword and a $0.73 increase in price at the lower end. These values are economically important relative to average keyword prices of $13.13 and $5.08 for the upper and lower end respectively. The significance of these estimates is robust to various specifications of the error structure. These results suggest that when state bar regulation makes it harder to contact personal injury victims by other marketing communications channels, lawyers are willing to pay relatively more for personal injury search advertising keywords. This implies that customizing prices based on context allows search engines to charge more when there is a lack of competition from other media channels. Furthermore, it suggests that search engines do compete with offline marketing communications channels. This may have implications for the way the antitrust authorities view future mergers involving media platforms that use context-based pricing.

State contingency fee limits are associated with a $2.27 decrease in the upper range price of personal injury keywords and a $1.86 decrease for the lower range of prices. This result is

[13] Errors clustered at the keyword level.

again robust to various specifications of the error structure. This suggests that when there are no state contingency fee limits to reduce the profitability of lawsuits, context-based ad pricing allows search engines to charge higher prices. Thus, these context-based ad prices are extremely sensitive to the profitability of the end customer.

We conducted a number of robustness checks on our results and present the results in Appendix Table 4. One concern is that our results are affected by missing data on prices. This happens because Google does not report an estimate of prices if there are not enough observations of past prices paid for particular keywords. A similar data sparseness issue was addressed by Rutz (2007), who uses Bayesian methods to help estimate search word performance for hotel search advertising data.[14] We ran further regressions to evaluate whether the missing data were systematically connected to the type of keyword or to the presence of solicitation regulations. We found no statistically significant evidence that they were. This lack of systematic correlation and the work of Little (1992) suggests that missing data are not driving our results. In addition, we ran Tobit specifications including the missing data that allowed for censoring of keyword prices both at the bottom of the observed range and the top of the observed range. The results, reported in Appendix Table 4 are similar to those reported in Table 3, although significance disappears for solicitation restrictions in the case where the missing values are assumed to be at the top of the observed range.

We also checked different definitions of the dependent and independent variables (shown in Appendix Table 4). For the dependent variable, we used log values of the price per click to ensure that our results hold for both percentage changes and for levels. All results are robust to this specification. For the independent variables, we wanted to verify that it was not an

[14] Unfortunately for our purposes, Google has not embraced this methodology.

idiosyncratic definition of “personal injury keyword” that led to our results. To allow for a broader definition of personal injury, we also tried a definition including “any violation of an individual's right, other than his or her rights in property”. This added the keywords associated with “dog bites”, “mold”, “toxic mold”, “premises liability”, “food poisoning” and “nursing home abuse” to the treatment group. The results were qualitatively similar.

Correspondingly, we were concerned our control keywords could be affected by contingency fee limits or solicitation regulations. This was a particular concern for keywords such as “Vioxx lawyer” or “Accutane attorney” that were associated with medical product class-action lawsuits. To ensure that these factors were not affecting our results, we also ran a more limited regression that used only the non-specialty keywords in Appendix Table 2 as controls. The results (shown in Appendix Table 4) are qualitatively the same as the main results.

## 6. Conclusion

There is a growing policy debate over whether the current search engine sales strategy of running a different set of ads and pricing these ads separately for each different search result, is designed merely to make advertising for customers more informative, or whether it is *also* an effective tool for extracting rents from advertisers. To shed light on this debate, we examine whether context-based pricing allows search engines to charge prices that reflect differences in the number of competing media channels that advertisers face and also differences in the profitability of client leads. Our research therefore departs both from existing studies of two-sided markets that focus on how content attracts customers when advertising prices are fixed, and also from the search engine advertising literature that has focused on modeling quality-adjusted second price auctions but takes the decision to price based on search result as being exogenously given.

There is an identification challenge in teasing apart demand from supply, given their endogeneity to unobserved market conditions. Therefore, we exploit cross-state variation in ambulance-chaser regulations. These regulations affect whether lawyers can contact clients by using alternative media, and whether there are contingency fee limits that affect the expected profitability of each client. When lawyers are not allowed to contact a personal injury or wrongful death client by mail, the relative price of a personal injury keyword is $0.93 higher. When there are contingency fee limits, the relative price of a personal injury advertisement is $2.27 lower. This is evidence that, in addition to making advertising more informative, context-based ad pricing allows search engines to extract rents when customers are more profitable and market competition is lower.[15] Furthermore, it suggests that online context-based advertising competes in a broader advertising market that includes offline marketing communications channels.

There are both managerial and policy implications to this research. From a managerial perspective, our results suggest that context-based pricing is an effective marketing strategy for extracting rents from advertisers. The academic literature has focused on the auction mechanism used in search engine advertising, but it is the combination of context-based pricing with an electronic auction mechanism that is crucial. It is therefore not clear that extending electronic auctions to other advertising networks without context-based advertising in place will necessarily be profitable. For example, it is not clear that Google's plans to bring online auctions to TV advertising and conduct these auctions on the basis of "daypart, geography and […] demographic", will prove as successful as its prior online search auctions that are conducted using context-based pricing.

[15] This result is useful for academics studying sectors where it is hard to obtain profitability information, in that researchers could use search engine keyword pricing as a guide to relative profitability of a customer.

Our research also sheds light on a growing policy debate about the welfare effects of displaying a different set of ads (with a different set of prices) for each set of search results. Though there may be consumer-welfare benefits, our research suggests context-based pricing also allows media platforms to extract rents effectively from advertisers. We leave it to future theoretical research explicitly to model the welfare trade-offs between improving the utility of advertising to consumers and extracting rents from advertisers. Our results also show that the online and offline marketing communications channels compete. These considerations will be critical for antitrust authorities when evaluating future industry consolidation across media platforms.

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## Appendix

### Appendix Table 1

| Variable | # of Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| CPC upper bound | 13455 | 13.13 | 10.42 | 0 | 80.17 |
| CPC lower bound | 13455 | 5.08 | 6.96 | 0 | 63.44 |
| Personal Injury Keyword | 33733 | 0.150 | 0.357 | 0 | 1 |
| Law restricting contingency fees | 33733 | 0.103 | 0.303 | 0 | 1 |
| Law restricting solicitation | 33733 | 0.303 | 0.459 | 0 | 1 |

**Appendix Table 2: List of Keywords**

| **Personal Injury Keywords** | **Other Keywords** | | |
|---|---|---|---|
| Medical Malpractice Lawyer | Child Support Attorney | Tenant Lawyer | Baycol Attorney |
| Personal Injury Attorney | Child Abuse Attorney | Arson Lawyer | Bextra Lawyer |
| Car Accident Attorney | Computer Crime Lawyer | Shoplifting Lawyer | Prempro Lawyer |
| Truck Accident Attorney | Sexual Assault Attorney | Benzene Lawyer | Celebrex Attorney |
| Asbestos Lawyer | Insurance Fraud Attorney | Forgery Attorney | Contract Attorney |
| Brain Injury Lawyer | Prenuptial Attorney | Extortion Attorney | Baycol Lawyer |
| Car Accident Lawyer | Living Will Lawyer | Extortion Lawyer | Serzone Attorney |
| Brain Injury Attorney | Money Laundering Lawyer | Perjury Lawyer | Crestor Lawyer |
| Wrongful Death Attorney | Traffic Violation Lawyer | Adoption Attorney | Meridia Attorney |
| Wrongful Death Lawyer | Computer Crime Attorney | Robbery Lawyer | Ephedra Lawyer |
| Personal Injury Lawyer | Child Support Lawyer | Perjury Attorney | Fosamax Lawyer |
| Mesothelioma Lawyer | Living Will Attorney | Meridia Lawyer | Zyprexa Lawyer |
| Aviation Accident Attorney | Credit Card Fraud Lawyer | Toxic Mold Lawyer | Tax Lawyer |
| Truck Accident Lawyer | Securities Fraud Attorney | Robbery Attorney | Accutane Attorney |
| Birth Injury Attorney | Food Poisoning Attorney | Prempro Attorney | Zyprexa Attorney |
| Asbestos Attorney | Domestic Violence Lawyer | Prostitution Attorney | Fosamax Attorney |
| Birth Injury Lawyer | Securities Fraud Lawyer | Adoption Lawyer | Celebrex Lawyer |
| Mesothelioma Attorney | Drug Possession Lawyer | Assault Lawyer | Benzene Attorney |
| Aviation Accident Lawyer | Identity Theft Attorney | Bankruptcy Lawyer | Ephedra Attorney |
| Construction Accident Lawyer | Workers Compensation Lawyer | Identity Theft Lawyer | Dui Lawyer |
| Medical Malpractice Attorney | Workers Compensation Attorney | Sexual Assault Lawyer | Prenuptial Lawyer |
| Construction Accident Attorney | Wrongful Termination Lawyer | Real Estate Lawyer | Theft Lawyer |
| | Wrongful Termination Attorney | Immigration Lawyer | Arson Attorney |
| | Nursing Home Abuse Attorney | Class Action Lawyer | Patent Attorney |
| **Neutral Keywords** | Intellectual Property Attorney | Class Action Attorney | Custody Lawyer |
| Lawsuit | Nursing Home Abuse Lawyer | Real Estate Attorney | Bextra Attorney |
| Law Firm | Money Laundering Attorney | Tenant Attorney | Custody Attorney |
| Litigation | Defective Products Attorney | Shoplifting Attorney | Vioxx Lawyer |
| mediation | Defective Products Lawyer | Bankruptcy Attorney | Accutane Lawyer |
| Attorney | Embezzlement Lawyer | Family Law Lawyer | Vioxx Attorney |
| Lawyers | Credit Card Fraud Attorney | Neurontin Attorney | Mold Attorney |
| Lawyer | Employment Lawyer | Child Abuse Lawyer | Mold Lawyer |
| Attorneys | Intellectual Property Lawyer | Theft Attorney | Paxil Attorney |
| mediator | Insurance Fraud Lawyer | Patent Lawyer | Alimony Lawyer |
| legal aid | Employment Attorney | Contract Lawyer | Visa Lawyer |
| legal help | Domestic Violence Attorney | Divorce Lawyer | Neurontin Lawyer |
| | Family Law Attorney | Forgery Lawyer | Paxil Lawyer |
| | Premises Liability Attorney | Oui Lawyer | Serzone Lawyer |
| | Drug Possession Attorney | Assault Attorney | Tax Attorney |
| | Traffic Violation Attorney | Prostitution Lawyer | Visa Attorney |
| | Estate Planning Attorney | Alimony Attorney | Divorce Attorney |
| | Food Poisoning Lawyer | Oui Attorney | Probate Attorney |
| | Estate Planning Lawyer | Landlord Lawyer | Crestor Attorney |
| | Premises Liability Lawyer | Dwi Attorney | Dui Attorney |
| | Toxic Mold Attorney | Landlord Attorney | Dog Bite Attorney |
| | Embezzlement Attorney | Dwi Lawyer | Dog Bite Lawyer |
| | Immigration Attorney | Probate Lawyer | |

## Appendix Table 3: Correlation Coefficients for State Laws and State Characteristics

| | Gross state product per capita | State population | Average CPC upper bound | Average CPC lower bound | Presence of solicitation regulation | Presence of contingency fee limit | Resident and active attorneys per dollar of state GSP | Total state trial-courts' incoming civil cases per 1000 population |
|---|---|---|---|---|---|---|---|---|
| **GSP per capita** | **1.00** | | | | | | | |
| **State population** | **-0.05** (0.70) | **1.00** | | | | | | |
| **Average CPC upper bound** | **-0.12** (0.42) | **-0.11** (0.46) | **1.00** | | | | | |
| **Average CPC lower bound** | **0.34*** ** (0.01) | **0.30** ** (0.03) | **0.16** (0.27) | **1.00** | | | | |
| **Solicitation regulation** | **-0.06** (0.65) | **0.03** (0.81) | **0.07** (0.63) | **0.15** (0.29) | **1.00** | | | |
| **Contingency fee limit** | **0.34*** ** (0.02) | **-0.13** (0.37) | **-0.16** (0.25) | **-0.05** (0.74) | **-0.26*** (0.07) | **1.00** | | |
| **Resident and active attorneys** | **0.03** (0.84) | **0.27*** (0.06) | **-0.17** (0.23) | **-0.09** (0.53) | **0.03** (0.84) | **0.07** (0.63) | **1.00** | |
| **Civil cases** | **0.25*** (0.09) | **0.03** (0.84) | **-0.09** (0.56) | **0.10** (0.49) | **0.00** (0.99) | **-0.16** (0.27) | **0.01** (0.95) | **1.00** |

**Appendix Table 4: Alternative Robustness Specifications**

| | Dependent variable relates to price per click of ranking first | | | | | Dependent variable is price per click of ranking third | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tobit with missing data coded as zero | Tobit with missing data coded as max | Logged price per click | Broader definition of personal injury keyword | Only neutral keywords as a control | Tobit with missing data coded as zero | Tobit with missing data coded as max | Logged price per click | Broader definition of personal injury keyword | Only neutral keywords as a control |
| Personal Injury Keyword *and* Law restricting solicitation | 1.933*** | 1.19 | 0.0490*** | 0.792*** | 1.205*** | 0.823** | 0.284 | 0.0248* | 0.609** | 1.564*** |
| | (0.34) | (1.31) | (0.012) | (0.25) | (0.37) | (0.34) | (1.18) | (0.014) | (0.26) | (0.38) |
| Personal Injury Keyword *and* Law restricting contingency fees | -0.486 | -5.95*** | -0.108*** | -2.096*** | -2.170*** | -1.171** | -5.30*** | -0.118*** | -1.674*** | -2.470*** |
| | (0.54) | (2.05) | (0.025) | (0.47) | (0.58) | (0.58) | (1.84) | (0.036) | (0.44) | (0.52) |
| Observations | 33733 | 33733 | 13444 | 13455 | 4359 | 33733 | 33733 | 7546 | 13455 | 4359 |
| R-squared | N/A | N/A | 0.90 | 0.84 | 0.77 | N/A | N/A | 0.95 | 0.64 | 0.60 |

Robust standard errors in parentheses
All regressions include a full set of dummies for each city and each keyword.
*** p<0.01, ** p<0.05, * p<0.1

**Figure 1: Upper Bound on Price per Click**

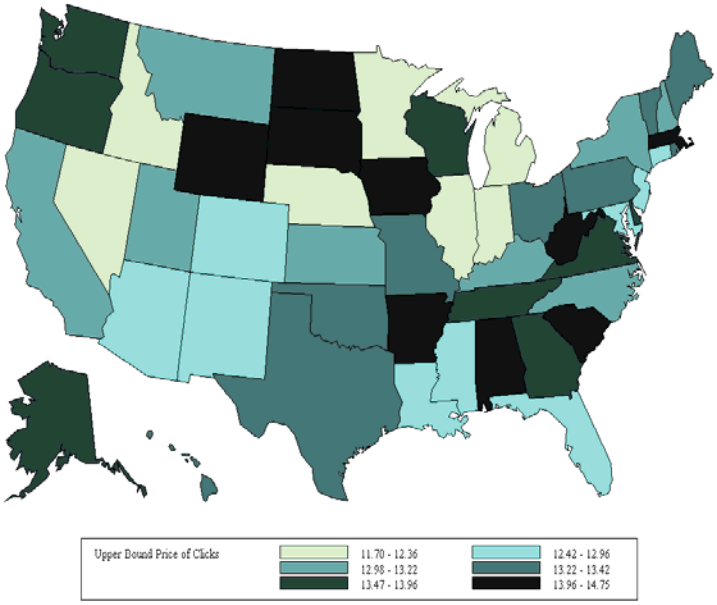


**Figure 2: Lower Bound for Price per Click**