

Location, Location, Location:

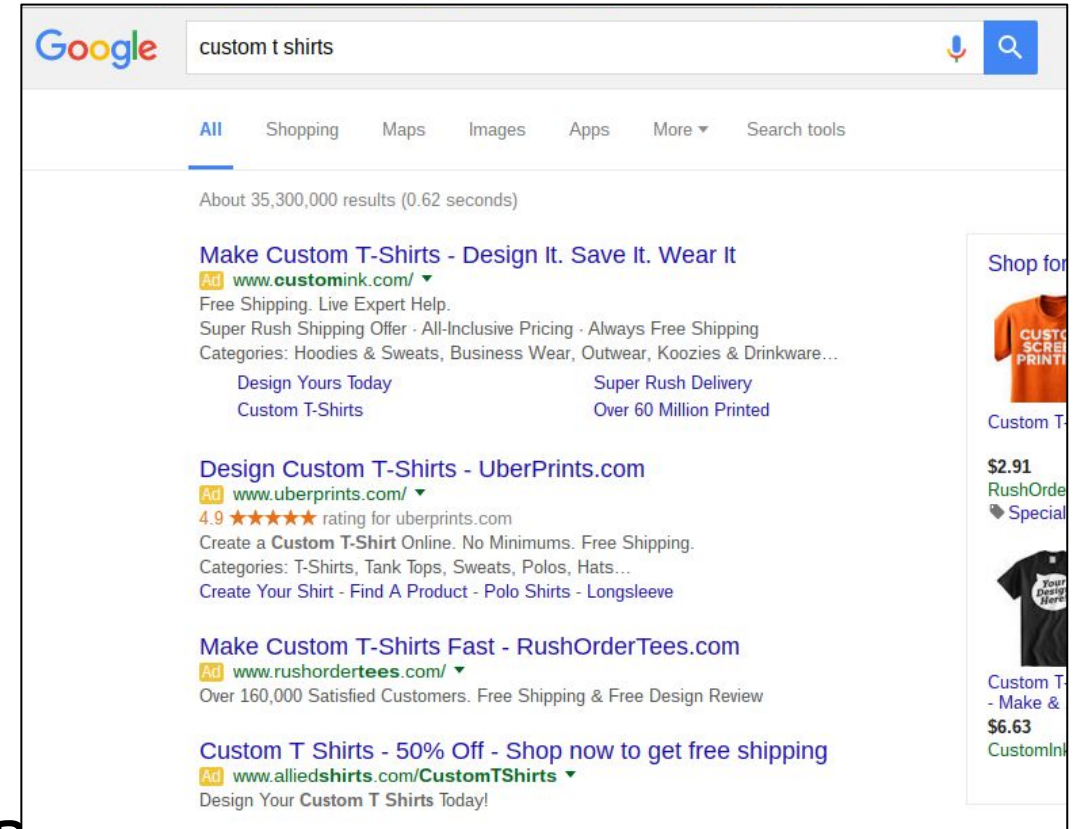
An Analysis of Profitability of Position in Online Advertising Markets

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Research Question

- How does **profitability** vary with ad position?
 - Different from CTR
 - Different from conversion percentage
 - Different from costs
- Nuanced relationship between keyword position & conversion percentage
 - Compare Ghose & Yang 2009



Methodology

- Calculate profit by position: $\pi(n) = I \times [\text{CTR}(n) \times \text{CONV}(n) \times \text{RPO} - \text{CTR}(n) \times \text{CPC}(n)]$,
- Structural model relating CTR, CONV, and Position:

○ CTR:

$$U_{kt}^{\text{CTR}} = \theta_0^k + \theta_1^k \text{Pos}_{kt} + \theta_2 \text{AdQuality}_{kt} + \sum_d \delta_{kt}^d \theta_{\text{DOW}_d} + \theta_{\text{Time}} \text{Time}_{kt} + \varepsilon_{kt}^\theta,$$

$$\theta^k = \Delta^\theta z_k + u_k^\theta, u_k^\theta \sim N(0, v^\theta), \quad \text{where } \theta^k = [\theta_0^k, \theta_1^k],$$

○ CONV:

$$U_{kt}^{\text{CONV}} = \beta_0^k + \beta_1^k \text{Pos}_{kt} + \sum_d \delta_{kt}^d \beta_{\text{DOW}_d} + \beta_{\text{Time}} \text{Time}_{kt} + \varepsilon_{kt}^\beta,$$

$$\beta^k = \Delta^\beta z_k + u_k^\beta, u_k^\beta \sim N(0, V^\beta), \quad \text{where } \beta^k = [\beta_0^k, \beta_1^k].$$

$$\begin{bmatrix} \varepsilon_{kt}^\theta \\ \varepsilon_{kt}^\beta \\ \varepsilon_{kt}^\alpha \end{bmatrix} \sim N(0, \Omega), \quad \text{where } \Omega = \begin{bmatrix} \Omega_{11} & \Omega_{12} & \Omega_{13} \\ \Omega_{21} & \Omega_{22} & \Omega_{23} \\ \Omega_{31} & \Omega_{32} & \Omega_{33} \end{bmatrix}.$$

○ Pos:

$$\ln(\text{Pos}_{kt}) = \alpha_0^k + \alpha_1^k \ln(\text{Bid}_{k,t}) + \alpha_2 \ln(\text{LQScore}_{k,t}) + \alpha_3 \text{CompBid}_{kt} + \sum_d \delta_{k,t}^d \alpha_{\text{DOW}_d} + \alpha_{\text{Time}} \text{Time}_{kt} + \varepsilon_{kt}^\alpha,$$

$$\text{with } \alpha^k = \Delta^\alpha z_k + u_k^\alpha \quad \text{and} \quad u_k^\alpha \sim N(0, V^\alpha).$$

Identification

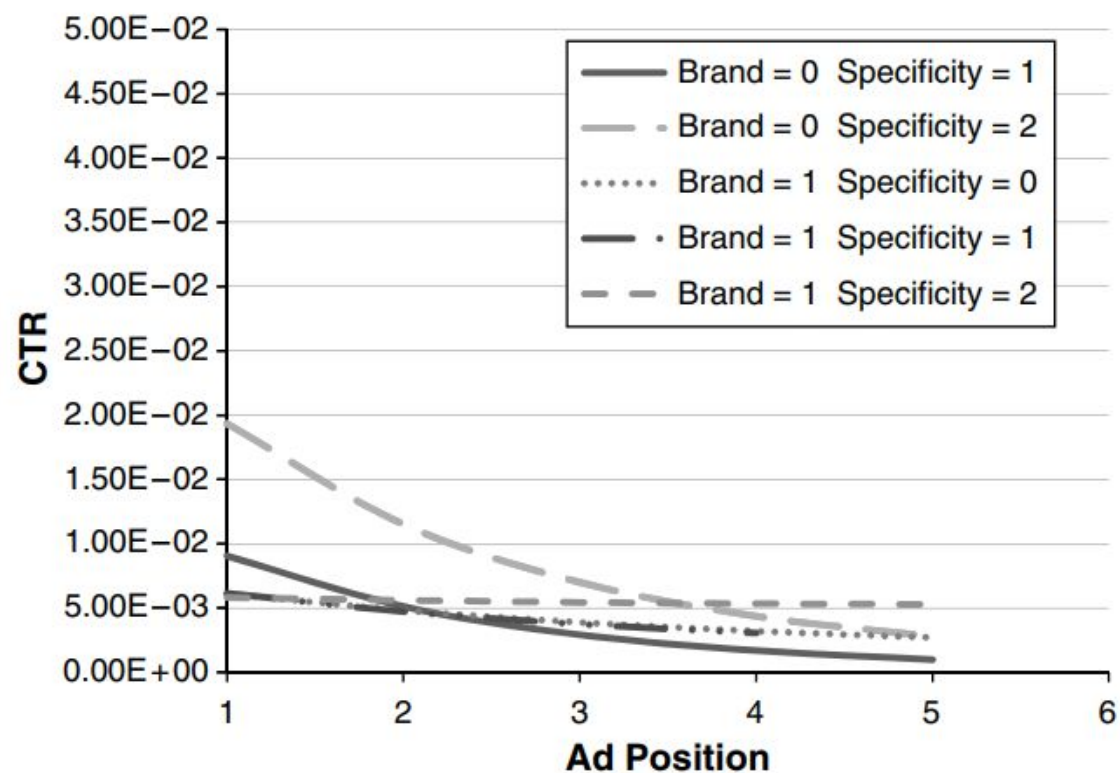
- Triangular system of equations

$$\begin{aligned}U_{kt}^{\text{CTR}} &= f(\text{Position}, X1, \varepsilon_{kt}^{\theta}), \\U_{kt}^{\text{CONV}} &= f(\text{Position}, X2, \varepsilon_{kt}^{\beta}), \text{ and} \\ \text{Position} &= f(X3, \varepsilon_{kt}^{\alpha}).\end{aligned}$$

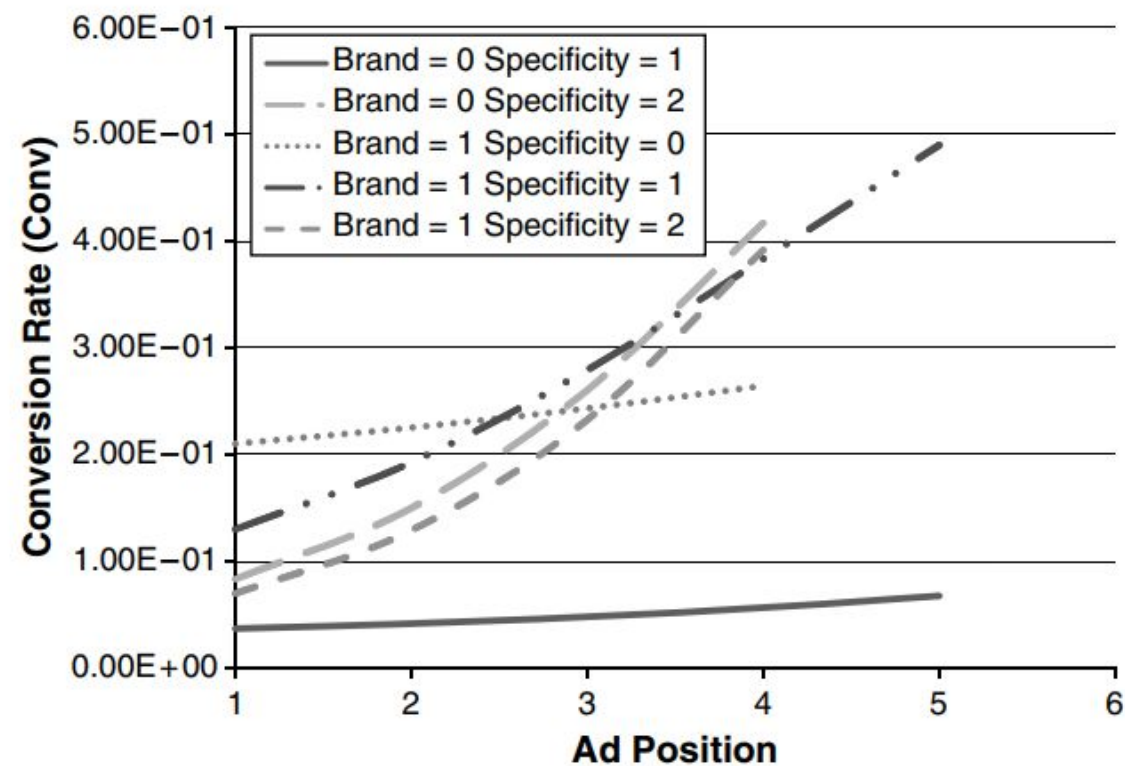
- Identification is possible since:
 - Bid (which is usually endogenous) was randomized throughout the experiment (making it exogenous)
 - other exogenous variables (LQScore, CompBid) are assumed to be “quasi-fixed”

Results

CTR AS A FUNCTION OF POSITION FOR SAMPLE KEYWORDS

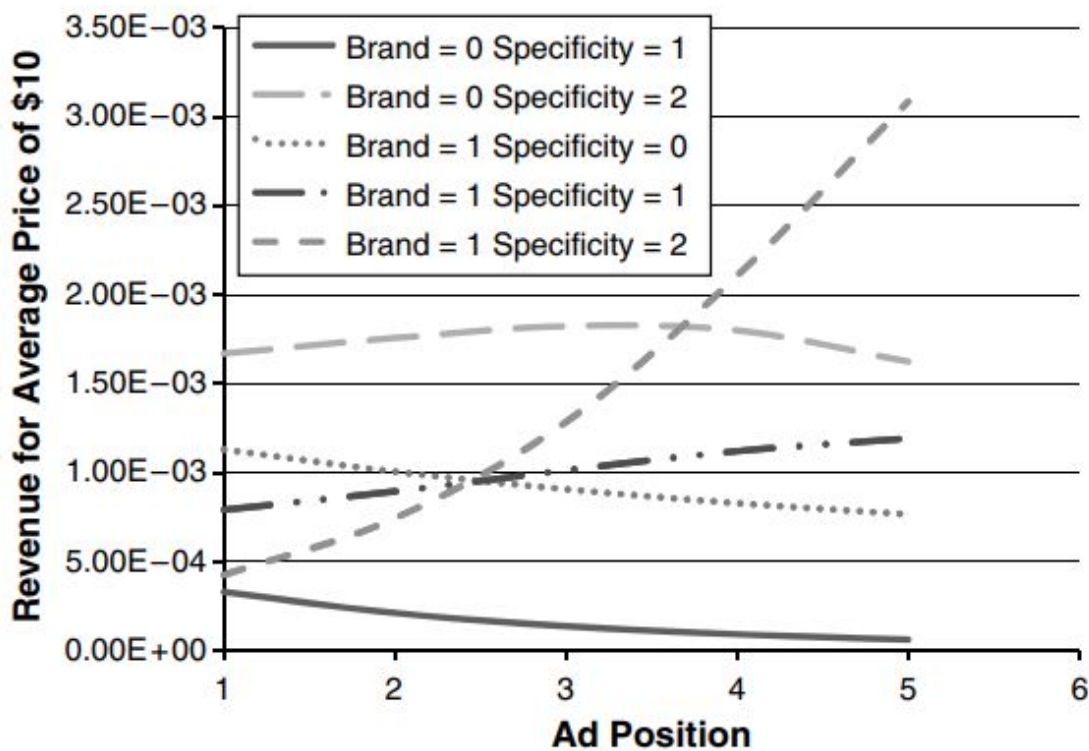


CONV AS A FUNCTION OF POSITION FOR SAMPLE KEYWORDS

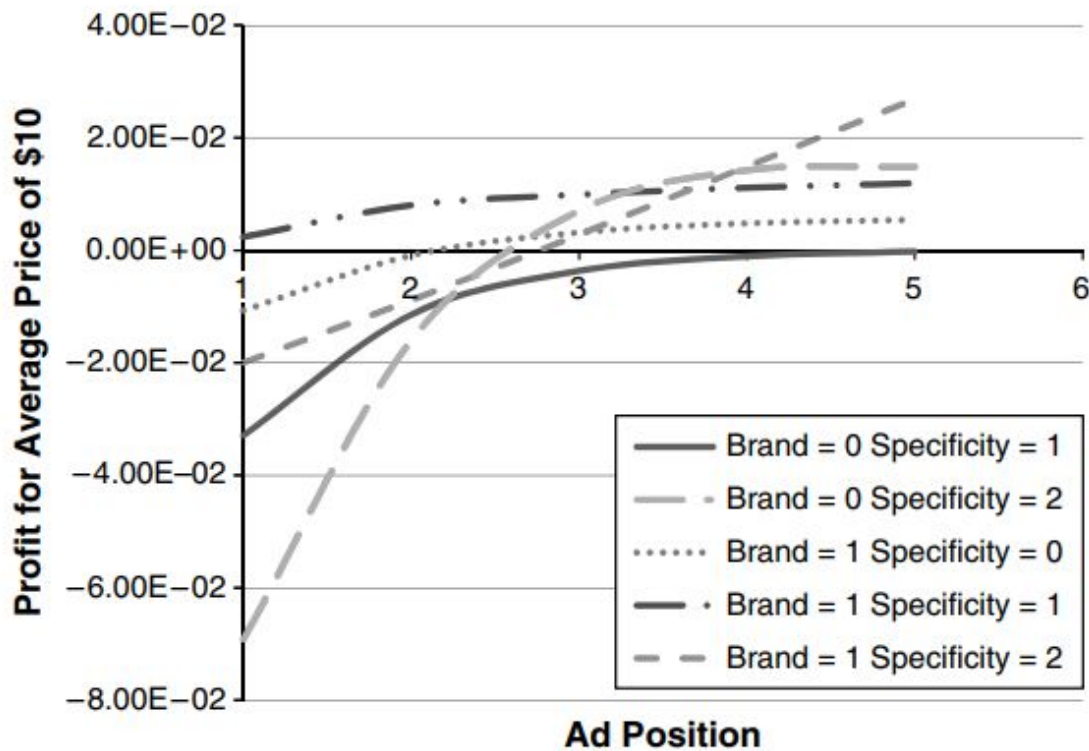


Results

REVENUE PER IMPRESSION AS A FUNCTION OF POSITION
FOR SAMPLE KEYWORDS



PROFIT PER IMPRESSION AS A FUNCTION OF POSITION
FOR SAMPLE KEYWORDS



Robustness Check

- Alternative retailer, bids *not* randomized, but still have some exogenous parameters
 - Bid choice is modeled as function of CPC and keyword performance for the past 7 days:

$$\begin{aligned}\ln(\text{Bid}_{k,t}) &= \gamma_0^k + \gamma_1 \text{CPC}_{k,t-1} + \gamma_2 \text{Pos}_{k,t-1} + \sum_d \delta_{k,t}^d \gamma_{\text{DOW}_d} \\ &\quad + \gamma_{\text{Time}} \text{Time}_{kt} + \varepsilon_{kt}^\gamma, \\ \gamma^k &= \Delta^\gamma z_k + u_k^\gamma u_k^\gamma \sim N(0, V^\gamma),\end{aligned}$$

- Similar results

Limitations

- Doesn't take into account "brand" advertising that's focused less on direct response (probably not a big deal for Google ads)
- Doesn't account for multiple searches by same consumer
- These variables probably wouldn't interact meaningfully with keyword position

Search Engine Advertising: Channel Substitution When Pricing Ads to Context

Avi Goldfarb (Toronto), Catherine Tucker (MIT)

2011 Management Science

Research Questions

- Is online advertising a complement or substitute for offline advertising?
- How does the role of targeting vs. broadcasting affect (mediate) this relationship?

Research Setting

- Client leads for personal injury/wrongful death lawyers are extremely lucrative and highly competitive
- Results in “ambulance chasing”, where lawyers will contact (visit, mail, call, email, etc.) individuals who have very recently suffered a major tragedy/accident
 - possibly while they’re still in the hospital, mourning a death, etc.
- Several (but not all) states have passed laws prohibiting this type of contact immediately after accidents/tragedies

Methodology

- Exploit exogenous variation in state regulations regarding “ambulance chasing” lawyers (personal injury & wrongful death)

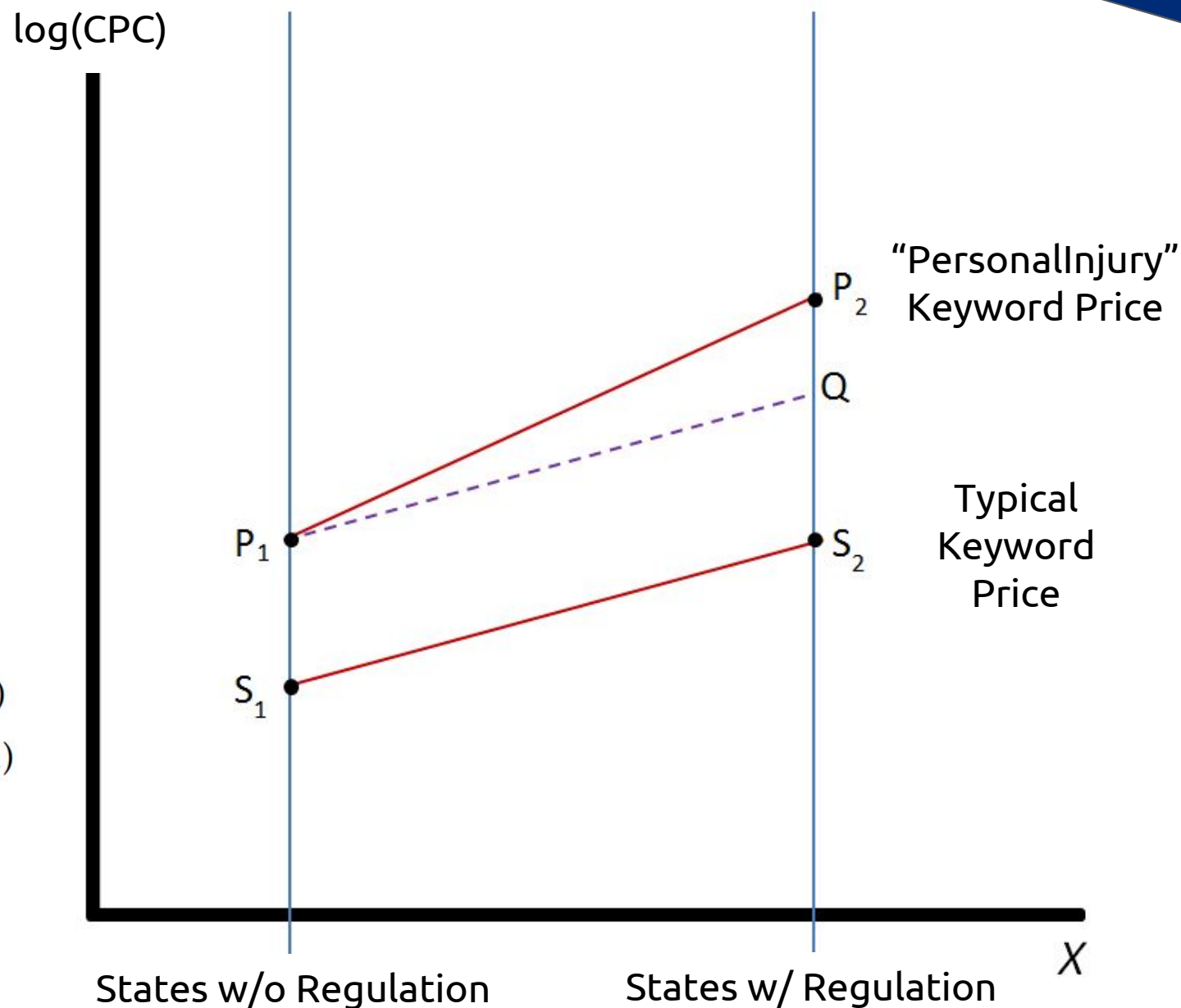
State	Personal injury regulations
Alabama	No written communication allowed for 30 days for personal injury or wrongful death
Arizona	No written communication allowed for 30 days for personal injury or wrongful death
Arkansas	No written communication allowed for 30 days for wrongful death
Colorado	No 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

- Obtain geographic locations

Identification

- Difference-in-differences
- Not across time, but rather across keyword types

$$\begin{aligned} \log(\text{CostPerClick}_{kl}) &= \beta(\text{PersonalInjuryWord}_k) \times (\text{SolicitationRestricted}_l) \\ &\quad + \text{Keyword}_k + \text{City}_l + \gamma \text{Controls}_{kl} + \varepsilon_{kl}. \end{aligned} \quad (1)$$



Results

Control Variables

Falsification Checks

- In Arkansas, regulations only prohibit lawyers from direct advertising/solicitation for **wrongful death, not personal injury**
 - Researchers find that keywords for “wrongful death” are higher than expected, whereas keywords for “personal injury” are not
 - Suggestive that difference in CPC is due to regulation

Falsification Checks

- No effect found for other keyword categories

Table 8 Falsification Check on Other Keyword Categories

	(1) Logged	(2) Logged	(3) Logged	(4) Logged	(5) Logged	(6) Linear	(7) Linear	(8) Linear	(9) Linear	(10) Linear
<i>Personal injury keyword and law restricting solicitation</i>	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)
<i>Civil case keyword and law restricting solicitation</i>	-0.018 (0.019)				-0.025 (0.019)	0.176 (0.154)				0.202 (0.137)
<i>Divorce law keyword and law restricting solicitation</i>		-0.0004 (0.018)			-0.023 (0.018)		-0.092 (0.138)			0.003 (0.089)
<i>Felony crime keyword and law restricting solicitation</i>			-0.010 (0.018)		-0.032 (0.021)			0.131 (0.200)		0.146 (0.214)
<i>Misdemeanor keyword and law restricting solicitation</i>				-0.006 (0.026)	-0.006 (0.025)				-0.035 (0.265)	-0.124 (0.299)
Observations	12,048	12,048	12,048	12,048	12,048	12,055	12,055	12,055	12,055	12,055
R^2	0.89	0.89	0.89	0.89	0.89	0.82	0.82	0.82	0.82	0.81

Mediation by Market Size

- Authors interpret this to strengthen their “substitution hypothesis”
- In smaller markets, broadcast/indirect advertising is much less cost effective than in large markets for reaching a very small population

Table 9 **Stratification by Market Size**

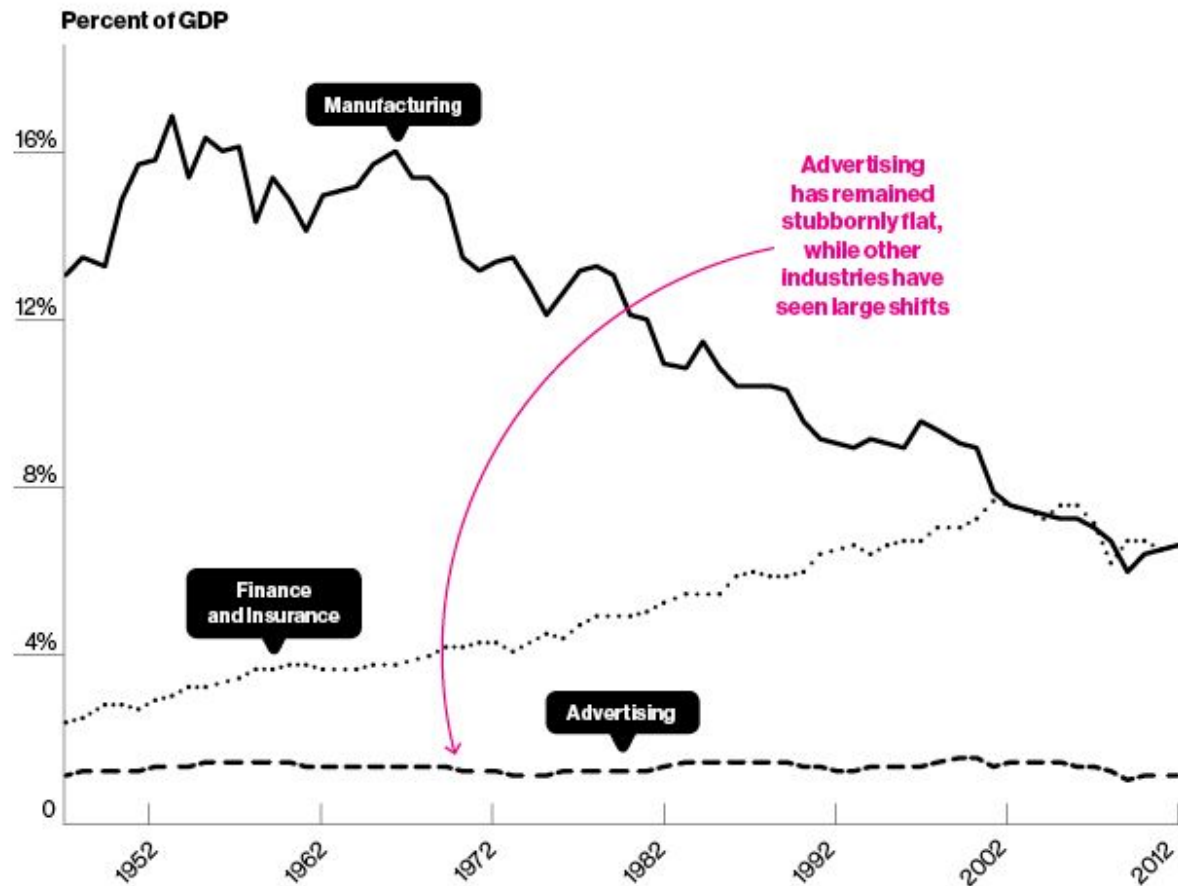
	(1) <1 million population	(2) >1 million population	(3) Below mean search volume	(4) Above mean search volume
Logged				
<i>Personal injury keyword and law restricting solicitation</i>	0.106** (0.045)	0.034** (0.014)	0.072*** (0.025)	0.013 (0.023)
Observations	6,624	5,424	9,622	2,426
R ²	0.90	0.90	0.86	0.96
Linear				
<i>Personal injury keyword and law restricting solicitation</i>	1.955*** (0.636)	0.401* (0.212)	1.155*** (0.362)	1.322*** (0.102)
Observations	6,629	5,426	9,629	2,426
R ²	0.80	0.86	0.80	0.95

Notes. The dependent variable is the midpoint of the keyword’s *estimated cost per click*. Robust standard errors clustered at the keyword level are given in parentheses. All regressions include a full set of fixed effects for each city and each keyword and the full set of controls from Table 5. The full set of coefficients is available from the authors.

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

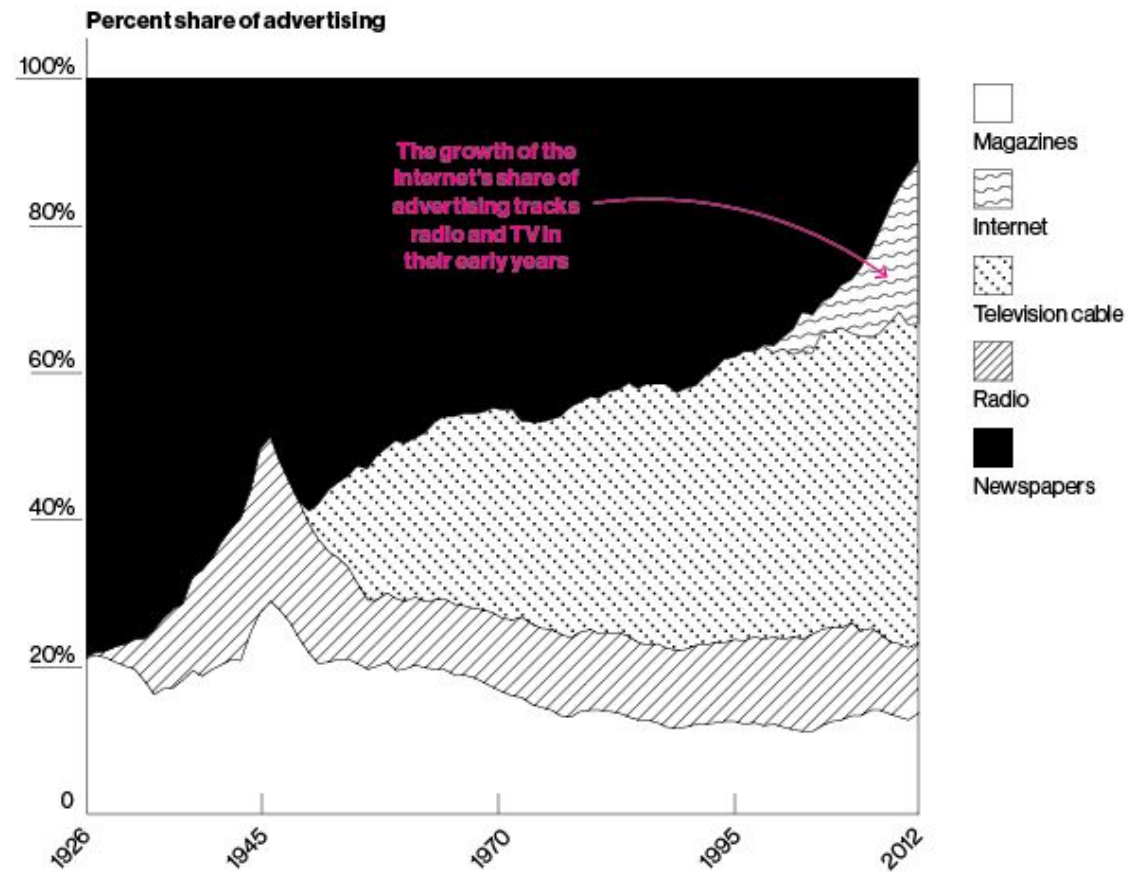
Perhaps not so surprising...

Ad Industry's Flat-Line Growth



GRAPHIC BY BLOOMBERG BUSINESSWEEK; DATA: DB5 RESEARCH

The Flow of Ad Dollars Over the Years



GRAPHIC BY BLOOMBERG BUSINESSWEEK; DATA: DB5 RESEARCH

Thank you

