

Web Appendix to Advertising Spillovers: Evidence from Online Field-Experiments and Implications for Returns on Advertising

A Estimation using a linear probability model

In this section, I go one-by-one over the estimated tables in the paper and re-estimate them using a linear probability model using OLS.

- Table 5 in the paper: Table 1 below replicates the Table 5 in the paper using OLS. It controls for heterogeneity across competitors in a more flexible manner using fixed effects for each competitor. It shows that the cross-ad effects on leads are correlated with restaurant characteristics. Specifically, restaurants that serve the advertised restaurant's cuisine benefit more from the spillovers if they have a higher rating. Those that are larger in terms of category-shares tend to gain less or even lose because of the experimental ad. There is no systematic correlation among restaurants that do not serve the experimental advertiser's cuisine. Column 2 replaces page-visits instead of leads as the dependent measure. As found in the paper, cross-ad effects in terms of page-visits are highest for the restaurants that serve the advertiser's cuisine and have the high ratings. Interestingly, larger restaurants (with high category shares) do not lose in terms of visits. The coefficient corresponding to (experimental-ad condition) \times (serving advertiser's cuisine) \times category-share is not negative when the dependent measure is page-visit.

- Table 6 in the paper: Table 2 replicates Table 6 in the paper. Note that the coefficient corresponding to $\text{Ad} \times (\text{Advertiser's category share})$ is positive and significant, indicating that the advertiser's benefits increase as they are larger in their category.
- Table 7 in the paper: Table 3 replicates Table 7 in the paper. It shows that the spillover effects to the competitors exist for low intensity of advertising. As the intensity increases, the spillovers disappear. For the advertiser, the benefit increases with intensity.
- Table 8 in the paper: Table 4 replicates Table 8 in the paper. It shows that an individual is likely to visit a competitor's page in the second session if she did so in the first session (column 1). Columns 2 - 3 show that low intensity advertising can hurt the advertiser in session 2, in terms of page visits. Column 4 shows that low intensity advertising did not hurt the competitors in session 1. Column 5 shows that this negative effect of low intensity advertising occurs through spillovers in the first session – the main negative effect decreases significantly when the interaction term is included in the model.
- Table 9 in the paper: Table 5 replicates Table 9 in the paper. It shows that the sales-response to advertising in session 1 is concave for the outcome (page-visit) in session 1. But when the focus is on the outcome in the longer-term, the response is convex (the quadratic term is positive, whereas the linear term is negative).
- Table 11 in the paper: Table 6 replicates Table 11 in the paper. It shows that an ad exposure benefits the competitors only when the individual has seen ≤ 1 ads before the current one.

		DV: Lead for a competitor	DV: Visit to a competitor's page
		(1)	(3)
(Experimental-ad condition) × (Serving experimental-advertiser's cuisine) ×	Rating	0.02** (0.007)	0.04** (0.02)
	Category	-1.1** (0.5)	-0.4 (1.25)
	Share		
	Price index	-2.3×10^{-5} (-2.1×10^{-5})	-3.9×10^{-5} (-4.6×10^{-5})
	Advertised during the study	-0.03 (0.03)	-0.01 (0.05)
	Intercept	-0.04 (0.05)	-0.13 (0.11)
(Experimental-ad condition) × (Different cuisine) ×	Rating	0.003 (0.003)	0.0004 (0.0005)
	Category	-0.6 (0.6)	0.54 (1.3)
	Share		
	Price index	-6.9×10^{-6} (1.3×10^{-5})	-1.5×10^{-5} (3.1×10^{-5})
	Advertised during the study	0.020 (0.014)	0.02 (0.03)
	Intercept	-0.03 (0.03)	0.04 (0.06)
Control for (Experimental-ad condition) × (Market fixed effects)	✓	✓	
Fixed effect for each competitor	✓	✓	
Sessions ¹	189,650	189,650	

¹ Standard errors are robust and clustered by session; units of observation is number of restaurants (100) times #sessions
** p<0.05, * p<0.1

Table 1: Regression in equation (4) of the paper (All coefficients are multiplied by 100 for ease of presentation.): Column 1: Leads for the competing restaurants on whether the session was in the experimental-ad condition; interacting the dummy indicator of the experimental-ad condition with (a) whether the competitor serves the advertiser's cuisine, and (b) other characteristics of the competitor including its rating and category share. Column 2 changes the dependent measure from a lead to a page-visit to a competitor.

	DV: Lead for the advertiser	
	(1)	(2)
Ad	0.08** (0.03)	0.2 (0.6)
Ad×Advertiser category share		1.9** (0.7)
Ad×Advertiser price index		4.5×10^{-7} (5.0×10^{-6})
Ad×Advertiser rating		-0.05 (0.06)
Intercept	0.19** (0.03)	0.20** (0.03)
Controlling for market share, category size	✓	✓
Controlling for Ad×Advertiser's chance of a lead in the absence of ads		✓
N	189,650	189,650

Robust standard errors in parentheses
** p<0.05, * p<0.1

Table 2: Regression: Lead for an experimental advertiser on an indicator of the ad condition and its interaction with the advertiser's characteristics. All coefficients are multiplied by 100 for ease of presentation.

DV: Sales lead						
	(1)	(2)	(3)	(4)	(5)	(6)
	Competition	Competition	Competition	Advertiser	Advertiser	Advertiser
Number of ad exposures (Ads)	0.01 (0.04)	-0.01 (0.04)		0.03** (0.01)	0.03** (0.01)	
1 ≤ Ads ≤ 3		0.37** (0.18)	0.39** (0.18)		0.05 (0.05)	0.11** (0.05)
4 ≤ Ads ≤ 7			0.11 (0.3)			0.22** (0.09)
8 ≤ Ads ≤ 10			-0.3 (0.5)			0.12 (0.16)
11 ≤ Ads			-0.05 (0.8)			0.37* (0.2)
Fixed effects:	✓	✓	✓	✓	✓	✓
Num pages, market						
N	89,720	89,720	89,720	89,720	89,720	89,720

Robust standard errors in parentheses

** p<0.05, * p<0.1

Table 3: Regression: Sales leads on the number of times the experimental ad is displayed. The dependent measure for columns 1, 2, & 3: spillover to any competitor serving the same cuisine as the advertiser; for columns 4, 5, & 6: leads for the advertiser . All coefficients are multiplied by 100 for ease of presentation.

	(1) DV: Competitor's page visit	(2) DV: Advertiser's page visit	(3)	(4)	(5)
	(session2)	(session2)	(session2)	(session1)	(session2)
$1 \leq \text{Ads}_1 \leq 3^{\mp}$	0.001 (0.006)	-0.006** (0.002)	-0.005** (0.002)	-0.002 (0.002)	-0.003 (0.002)
Ads_1	-0.0003 (0.002)	0.0011* (0.0006)		0.002** (0.0006)	0.0011* (0.0006)
$\text{Comp_visit}_1^{\natural}$	0.36** (0.01)	0.006** (0.002)	0.006** (0.002)	0.02** (0.002)	0.01** (0.003)
$(1 \leq \text{Ads}_1 \leq 3) \times \text{Comp_visit}_1$					-0.01** (0.005)
Ads_2	-0.0004 (0.002)	0.0014** (0.0007)	0.0014** (0.0006)	-0.001 (0.001)	0.0014** (0.0007)
Controlling for Num Pages ₁ , Num Pages ₂	✓	✓	✓	✓	✓
N	17,653	17,653	17,653	17,653	17,653

Robust standard errors in parentheses

** p<0.05, * p<0.1

\mp : Ads_1 is the number of ad exposures in session 1

\natural : Comp_visit_1 is an indicator of a competitor's page visit in session 1

Table 4: Regression: Page visits in the second session (session 2) on the number of times the experimental ad is displayed in the first session (session 1). The dependent measure for column 1: page visit to any competitor serving the same cuisine as the advertiser; for columns 2 - 5: visit to the advertiser's page.

	(1)	(2)
	DV: Visit to the advertiser's page in (session1)	(session2)
Ads_1	0.003** (0.001)	-0.002* (0.001)
Ads_1^2	-0.0001 (0.0001)	0.0003** (0.0001)
Ads_2		✓
Num Pages ₁	✓	✓
Num Pages ₂		✓
N	17,653	17,653

\mp : Ads_k is the number of ad exposures in session k

Robust standard errors in parentheses

** p<0.05, * p<0.1

Table 5: Comparing the impact of ads in the first session on outcomes in the first and second sessions

	Same-Cuisine Competitors		Advertiser	
	(1)	(2) Page Number >2	(3)	(4) Page Number >2
Ad exposure	0.08 (0.08)	0.53** (0.23)	0.1** (0.05)	0.06 (0.08)
Ad×(# ads seen before >1)		-0.61** (0.27)		0.06 (0.1)
Fixed effect for every combination (Page number × # of ads seen before)	✓	✓	✓	✓
N	259,237	110,839	259,237	110,839

Robust standard errors in parentheses (** p<0.05, * p<0.1)

Table 6: Effect of ad exposure on a page in a session, conditioned on prior browsing and ad exposure in the session. Regression: unit of observation is a page at which a user arrives (rather than a session). The dependent measure is a dummy indicator of whether a lead is generated during the session for the competitors (columns 1 & 2) and the advertiser (columns 3 & 4). All coefficients are multiplied by 100 for ease of presentation.