Wasn't That Ad for an iPad?
Display Advertising's Impact on Advertiser- and Competitor-Branded Search

Randall Lewis

Dan Nguyen

Outline

Introduction

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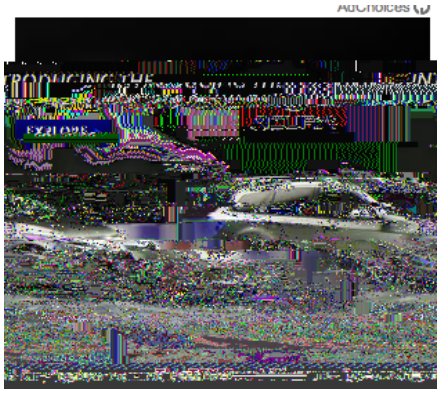

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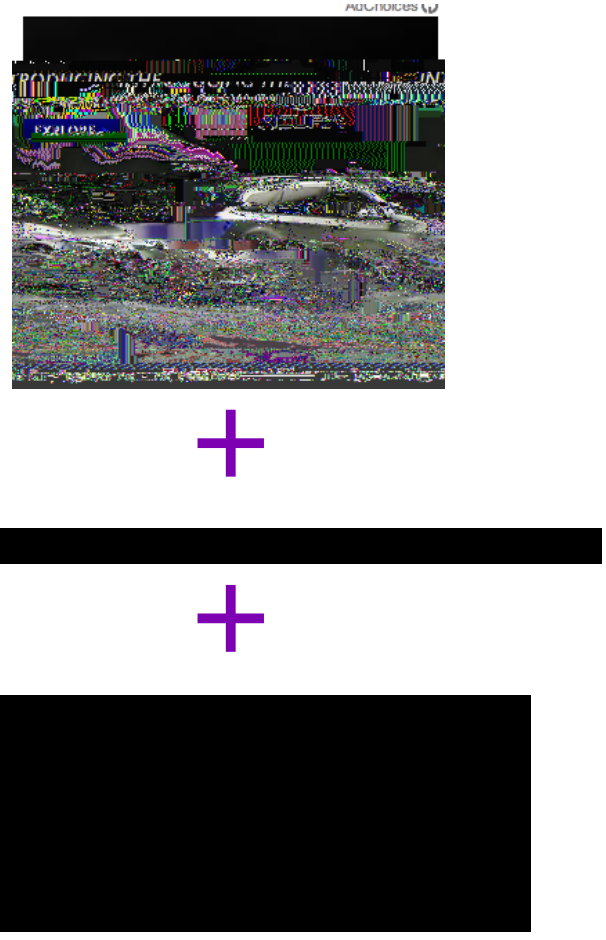

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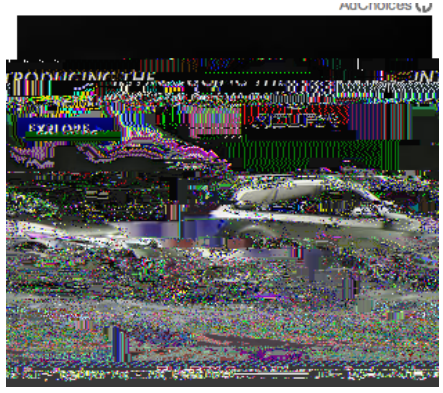
We use our ndings to explore the economic impacts of advertising spillovers display advertising market on the search advertising market and on rms' investment in advertising.



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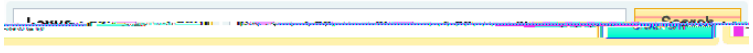

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Related Literature

Research on Advertising and Online Searching

Mayzlin and Shin (2011): separating equilibrium in which high quality rms opt invite the consumer to search.

Swasy and Rethans (1986): found in the lab that advertising for new products creates curiosity among consumers with high product category knowledge.

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Research on Effects Across Media Channels

Alba and Chattopadhyay (1985): cueing a brand inhibited recall of other category and related brands.

Nedungadi (1990): priming of a minor brand increases retrieval and consideration of major brand, but not vice versa.

Related Literature

Research on Display Advertising E ectiveness

- Dreze and Hussherr (2003): users avoid looking at display ads, but frequency increased unaided brand recall.
- Lewis (2010): click-through rates modestly decline in the number of impressions shown a user.
- Goldfarb and Tucker (2011a,b): limits on targeting reduce, but match and obtrusiveness increase ad e ects on surveyed purchase intent.

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Yahoo! sells the primary ad unit on Yahoo!'s front page, www.yahoo.com, to one advertiser for the whole day or splits the day between two advertisers.

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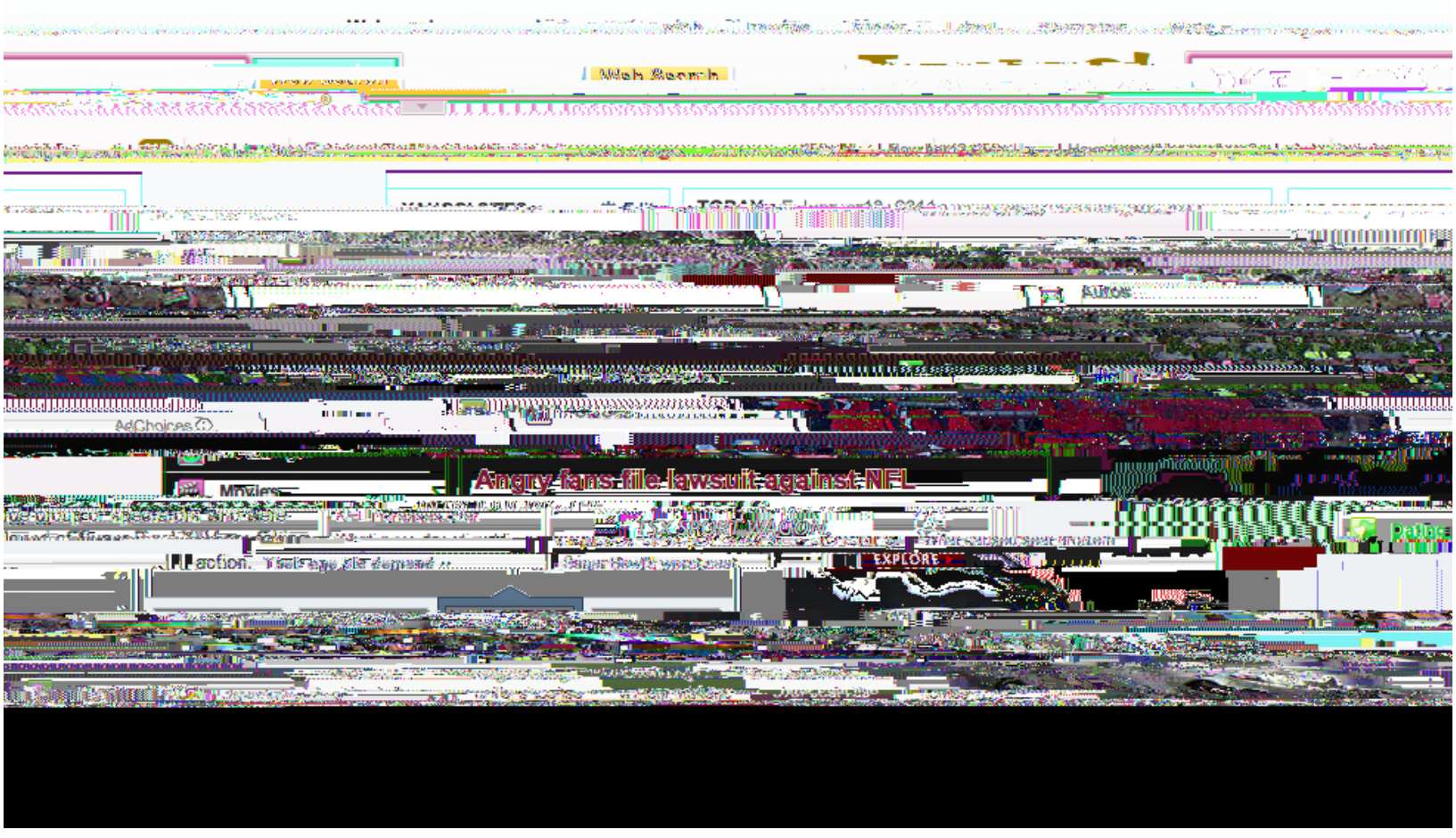
This provides a natural experiment to analyze the e ects of advertising.

Example of Ad Split on February 10, 2011



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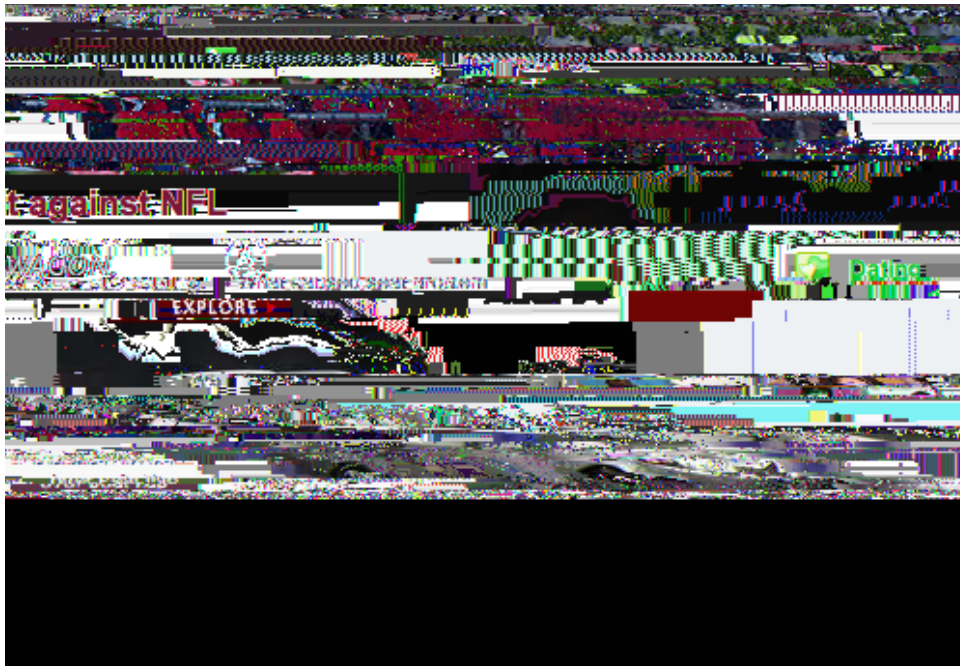

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We record the anonymous user's searches on Yahoo! for ten minutes after the ad is delivered.

The delivery of each target (control) ad impression marks the start of a treatment (control) period.

Each period ends either after ten minutes or when another impression is delivered to the same user, whichever comes first.

- Ten minutes should be long enough for users to act upon the ad and short enough to avoid misattributing activities to the wrong ad impression.
- A ten minute window also yields the most statistical power.

Outline

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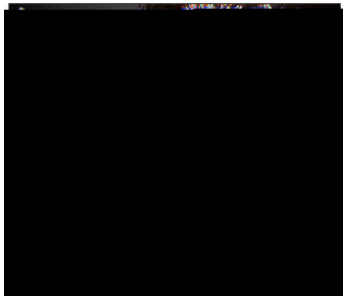
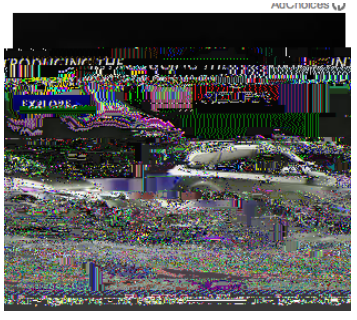
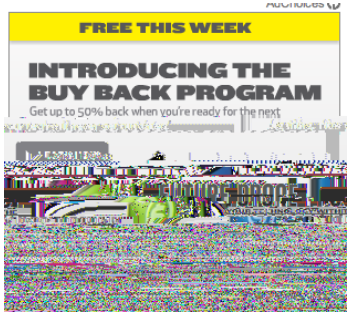
The Ad Campaigns

Date of Ad Split	Target Ad	Control Ad
11 January 2011		
10 February 2011		
29 June 2011		

The Search Keywords

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Lists of competitors' brands were collected online.

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Progressive's Competitors' Brands

- 14 brands.
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Acura's Competitors' Brands

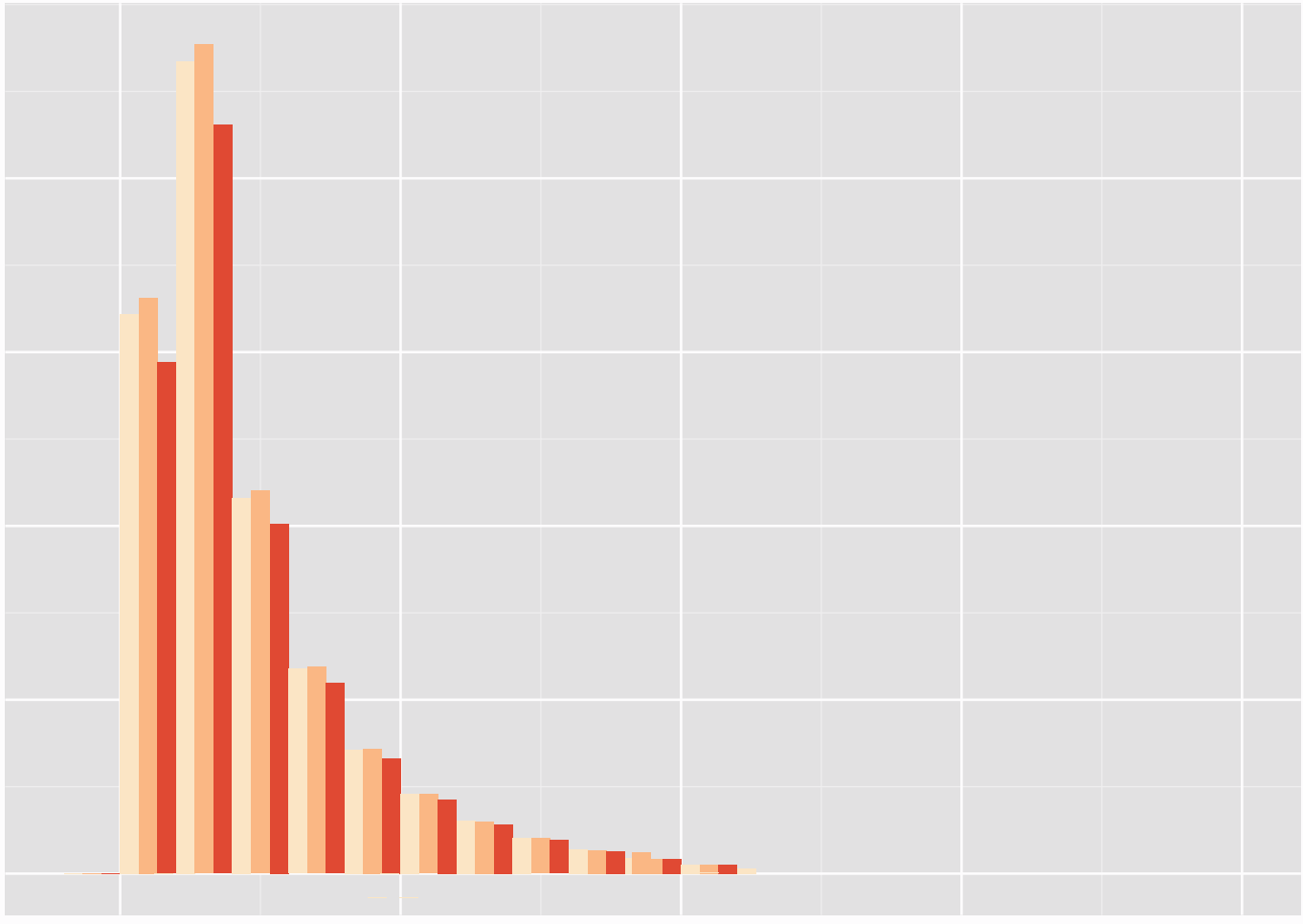
- 36 brands.
- Examples: Audi, BMW, Ford, and Lexus.
- Source: Autobytel.com.

Samsung Galaxy Tab's Competitors' Brands

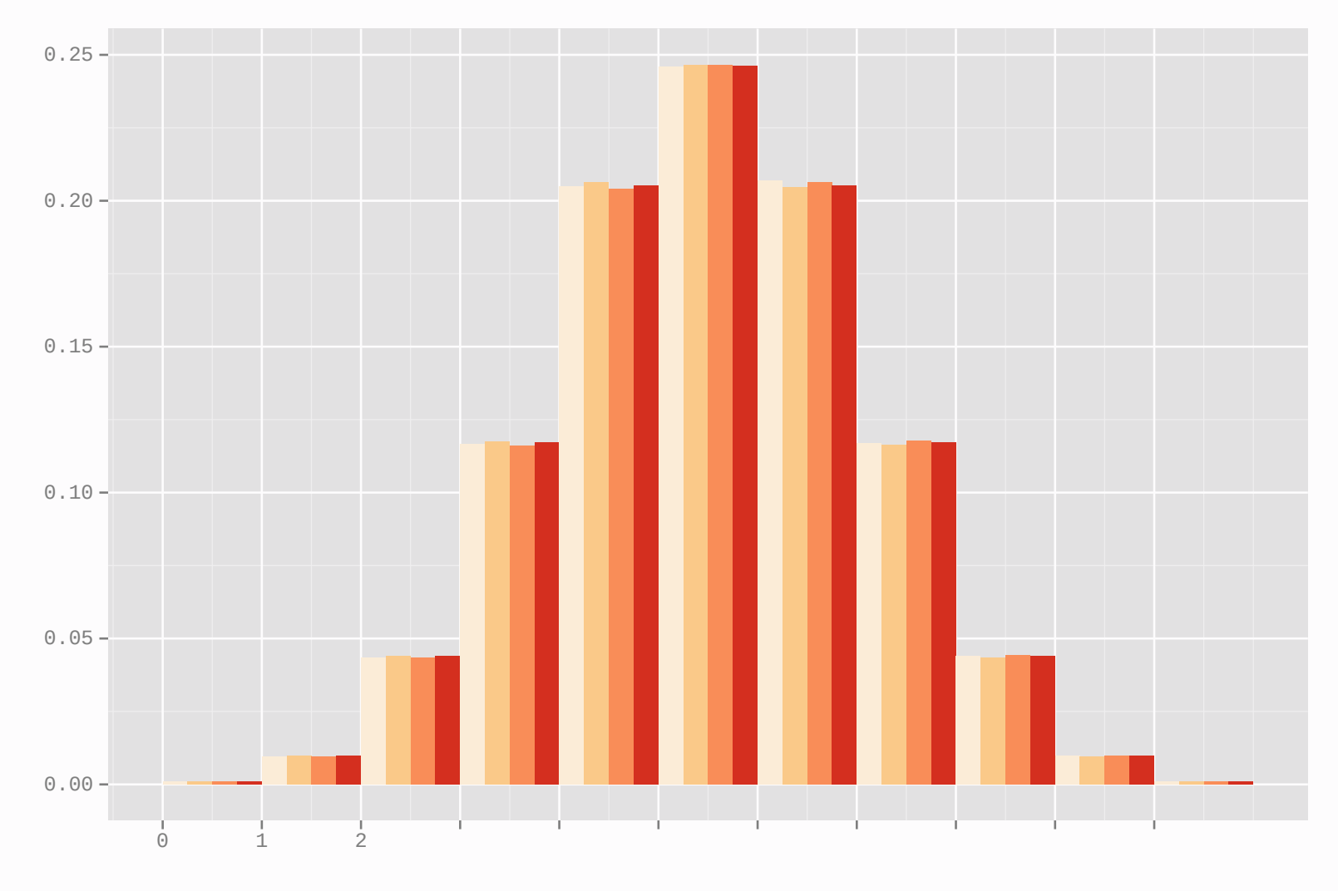
- 15 brands.
- Examples: Apple iPad, Blackberry Playbook, and Motorola Xoom.
- Source: \CNETG 0 g TG 0 g TG 0 g TG 0 g TG 0 0 1 2f -2000.02579 cm 1 0

Outline

Distribution of Total Number of Exposures to the Test Ad



Distribution of Total Number of Exposures to the Target Ad for Users Who Visited the Front Page 10 times



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Using OLS, we estimate $_j$ to obtain the average increase in searches for product j caused by the display ad.

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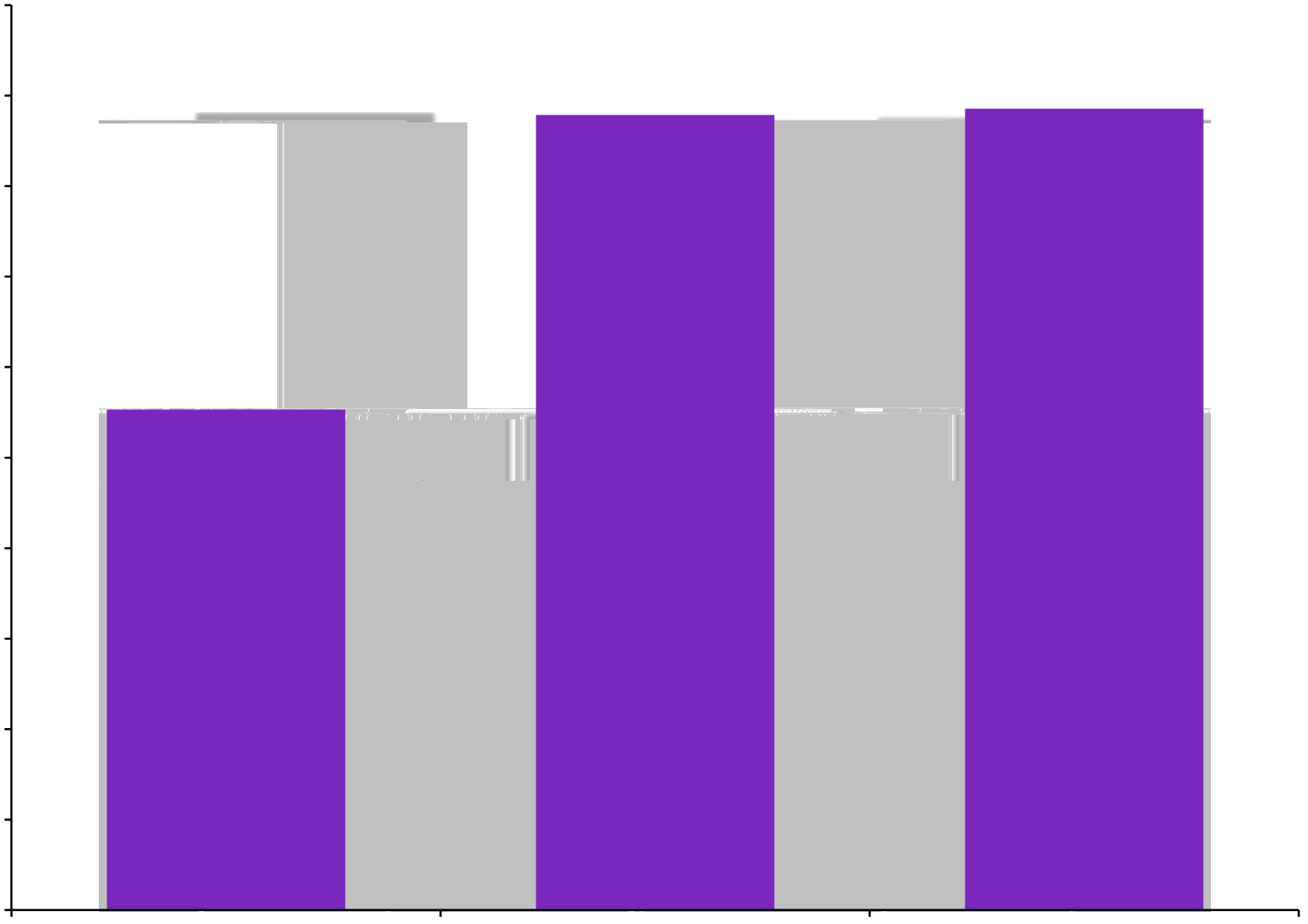
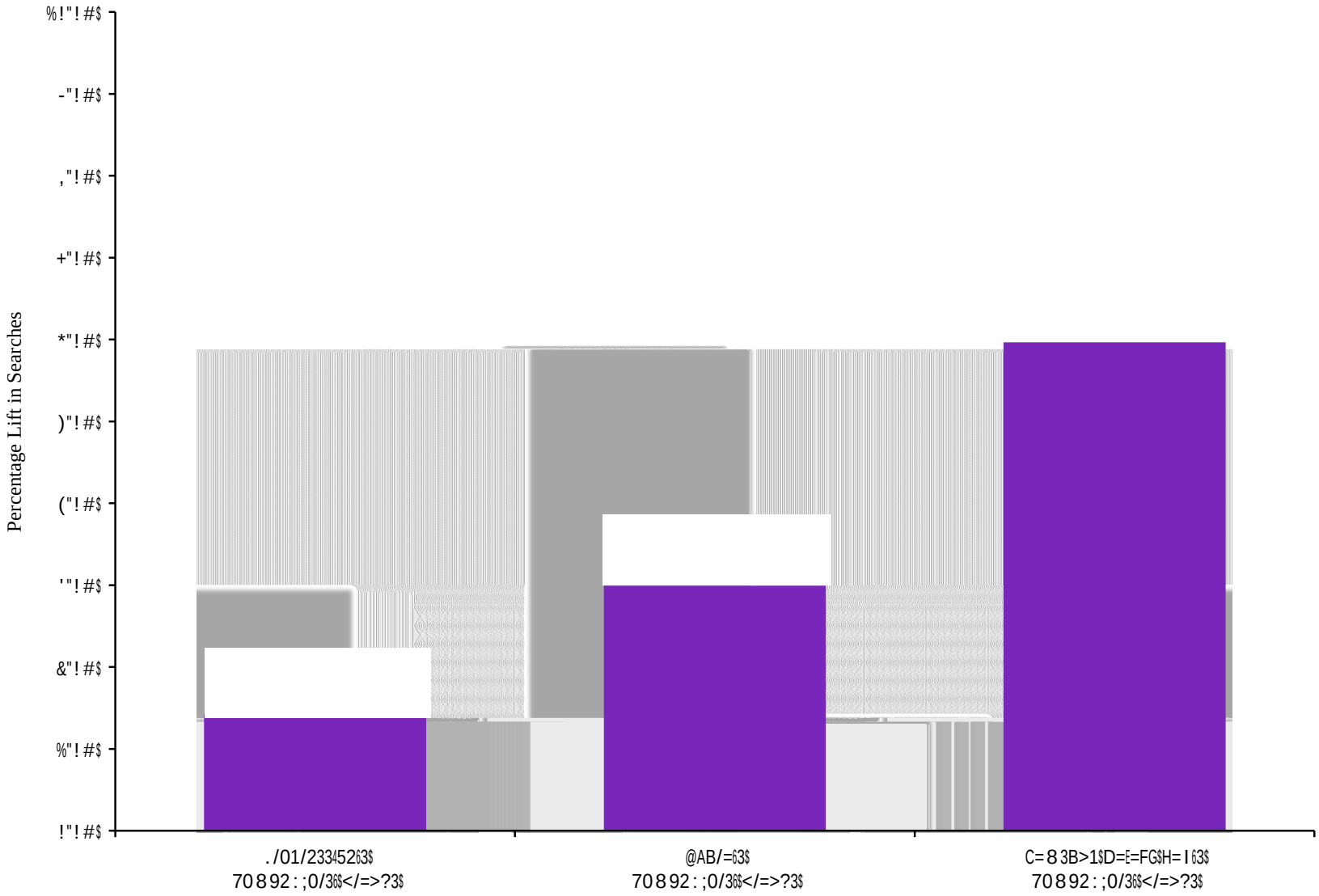
Signi cant Lift in Searches for the Advertiser



Table

Signi cant Lift in Searches for the Competitors



▸ Table

No Signi cant Decrease in Searches for Any Competitors: Progressive's Competitors

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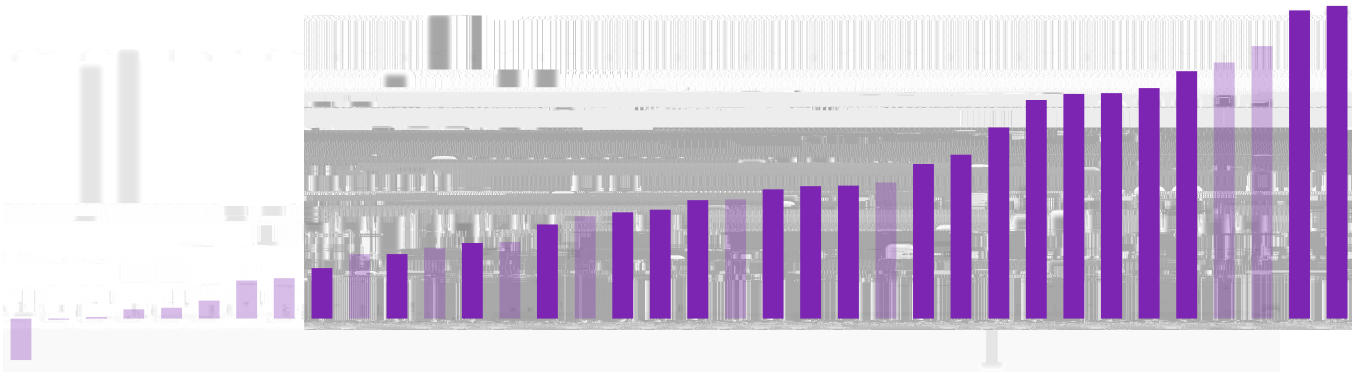

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No Signi cant Decrease in Searches for Any Competitors: Samsung Galaxy Tab's Competitors

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Two Sets of Robustness Checks Con rm the Main Findings

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- Pros: Provides a much richer view of the e ects of the advertising.
- Cons: False discovery risks require higher levels of statistical signi cance to avoid spurious conclusions.

Robustness Checks Limiting the Sample to the First Impressions

	!"#$%&'(#) $%)&19/$*+0,	6&+#7$8.,&#$ %)&19/$*+0,	*+'+,)-$,.$,/)$ 0+12,$+'(1)22+.3 *.4)1$:."3- ;<=$>?	@(()1$:."3- ;<=$>?	6&+#7$8.,&#$ %)&19/$*+0,	*+'+,)-$,.$"2)12$4/.$4)1)$ -)#+5)1)-$.3)$+'(1)22+.3 *.4)1$:."3- ;<=$>?	@(()1$:."3- ;<=$>?
Samsung Galaxy Tab Advertising Campaign							
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Acura Advertising Campaign							
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Progressive Auto Insurance Advertising Campaign							
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More directly, it can also decrease the CPC for a x expected number of clicks by the nature of the generalized second price (GSP) auction.

Decreasing CPC for a xed expected number of clicks

In the GSP auction, CPC is increasing with CTR on a given search result page.

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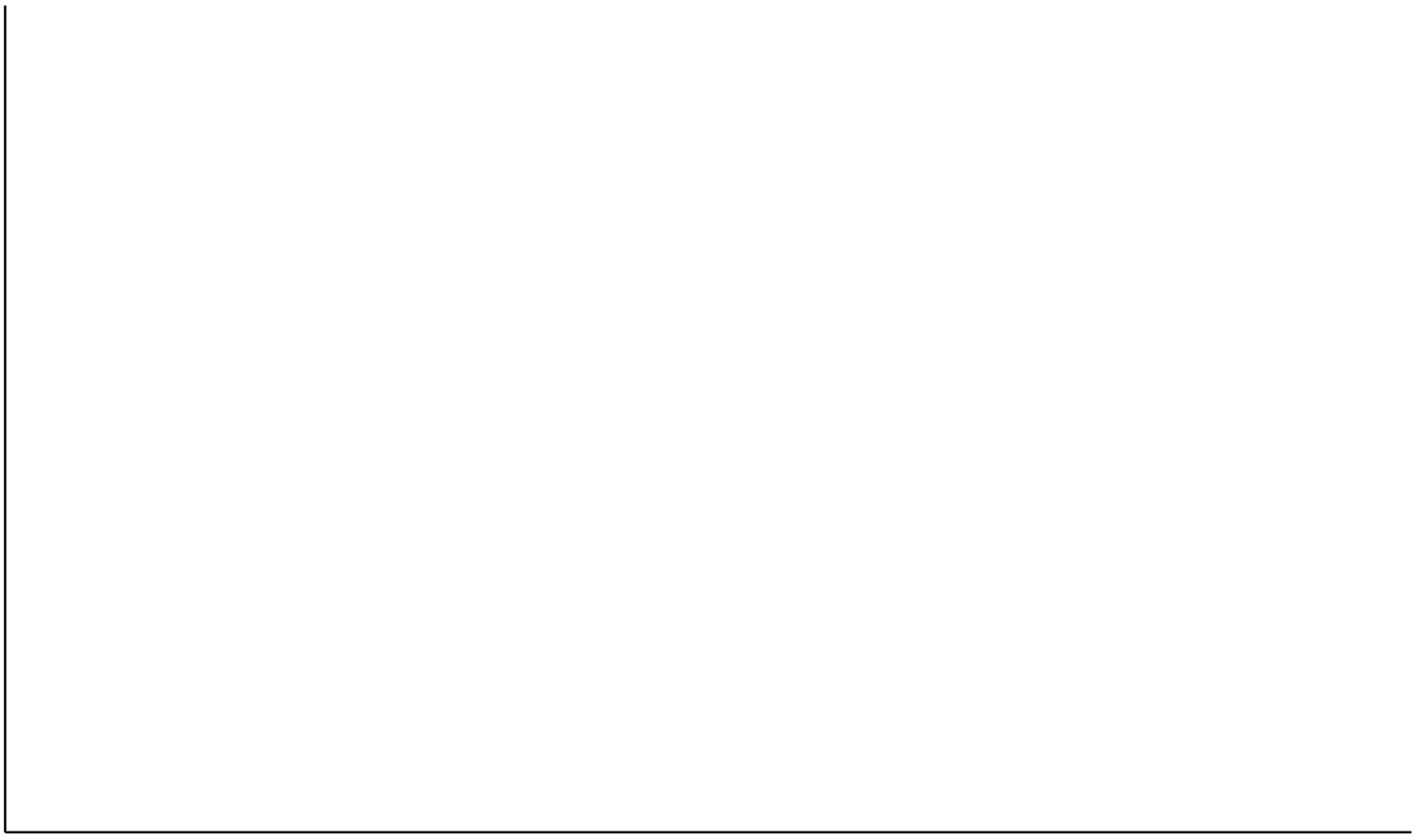
As a result, display advertising increases the marginal pro tability of a click for both the display advertiser and its competitors by increasing the number of searches.

Display advertising is both a strategic complement and complement to search advertising

▸ Formal Model

CPC Increases with CTR



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Magnitude of Spillovers vs. Equilibrium Prices

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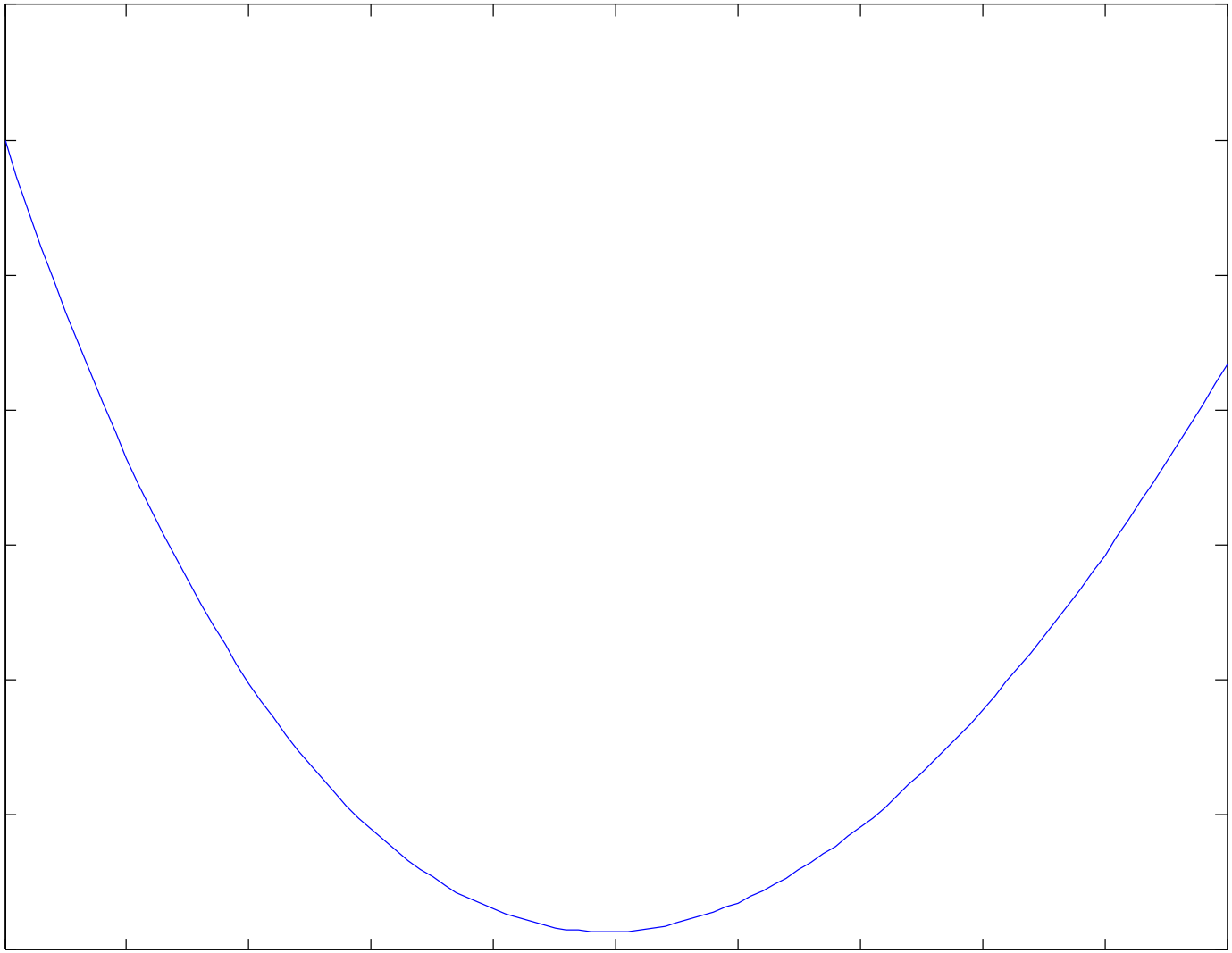

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Magnitude of Spillovers vs. Equilibrium Pro ts

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Spillovers

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- \iPad" received twice as many incremental searches as \Galaxy Tab."

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Table: Percentage Lift in Searches

Searches	Control			Search Lift from Advertising			Percentage Lift	Competitor/ Own
	Estimate	OLS T-stat	Cluster T-stat	Estimate	OLS T-stat	Cluster T-stat		
Sa Ga a Tab Ad e Ca a								
Samsung Galaxy Tab		19.78	20.57		6.20	6.32	44.3%	1.00
All Competitors		89.87	82.42		3.79	3.81	6.0%	2.34
Apple Ipad		68.64	63.21		4.23	4.25	8.7%	2.02
Motorola Xoom		17.23	16.74		2.79	2.79	22.8%	0.36
Blackberry Playbook		11.92	11.34		1.89	1.90	22.4%	0.17
Viewsonic		2.55	3.00		1.39	1.39	77.2%	0.03
Ac a Ad e Ca a								
Acura		38.12	38.34		11.84	11.78	43.9%	1.00
All Competitors		445.80	389.84		9.43	9.44	3.0%	7.74
Volkswagen		52.12	48.24		5.64	5.62	15.3%	0.58
Hyundai		50.05	46.94		5.59	5.55	15.8%	0.55
Lexus		42.54	39.37		4.86	4.85	16.2%	0.41
Volvo		31.39	29.31					

Go Back

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All Competitors		89.87	82.42		3.79	3.81	6.0%	2.34
Apple Ipad		68.64	63.21		4.23	4.25	8.7%	2.02
Motorola Xoom		17.23	16.74		2.79	2.79	22.8%	0.36
Blackberry Playbook		11.92	11.34		1.89	1.90	22.4%	0.17
Viewsonic		2.55	3.00		1.39	1.39	77.2%	0.03
Ac a Ad e Ca a								
Acura		38.12	38.34		11.84	11.78	43.9%	1.00
All Competitors		445.80	389.84		9.43	9.44	3.0%	7.74
Volkswagen		52.12	48.24		5.64	5.62	15.3%	0.58
Hyundai		50.05	46.94		5.59	5.55	15.8%	0.55
Lexus		42.54	39.37		4.86	4.85	16.2%	0.41
Volvo		31.39	29.31					

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Table: Percentage Lift in Searches for Progressive's Competitors

Control

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Table: Percentage Lift in Searches for Acura's Competitors

	Control			Search Lift from Advertising				
Searches	Estimate	OLS T-stat	Cluster T-stat	Estimate	OLS T-stat	Cluster T-stat	Percentage Lift	Competitor/ Own
Acura		38.12	38.34		11.84	11.78	43.9%	1.00
All Competitors		445.80	389.84		9.43	9.44	3.0%	7.74
Volkswagen		52.12	48.24		5.64	5.62	15.3%	0.58
Hyundai		50.05	46.94		5.59	5.55	15.8%	0.55
Lexus		42.54	39.37		4.86	4.85	16.2%	0.41
Volvo		31.39	29.31		4.86	4.75	21.9%	0.31
Subaru		37.21	34.82		4.56	4.58	17.3%	0.33
Honda		97.46	87.44		4.54	4.57	6.6%	

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Table: Percentage Lift in Searches for Samsung Galaxy Tab's Competitors

	Control			Search Lift from Advertising				
Searches	Estimate	OLS T-stat	Cluster T-stat	Estimate	OLS T-stat	Cluster T-stat	Percentage Lift	Competitor/ Own
Samsung Galaxy Tab		19.78	20.57		6.20	6.32	44.3%	1.00
All Competitors		89.87	82.42		3.79	3.81	6.0%	2.34
Apple Ipad								

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A Stylized Model of Complements

Pro t Function

$$(A_d; A_s) = A_d v_d + A_s v_s + A_d P_d(A_d) + A_s P_s \quad \frac{A_s}{Q_s(A_d)}$$

A Stylized Model of Complements

Pro t Function

$$(A_d; A_s) = A_d v_d + A_s v_s + A_d P_d(A_d) + A_s P_s \quad \frac{A_s}{Q_s(A_d)}$$

Marginal Pro t w.r.t. A_s

$$\frac{@}{@A_s} = v_s \quad P_s \quad \frac{A_s}{Q_s(A_d)} \qquad \frac{A_s}{Q_s(A_d)} P_s^{\theta} \quad \frac{A_s}{Q_s(A_d)}$$

A Stylized Model of Complements

Pro t Function

$(A_d; A_s) = A_d$

A Stylized Model of Complements

Pro t Function

$$(A_d; A_s) = A_d v_d + A_s v_s + A_d P_d(A_d) + A_s P_s \quad \frac{A_s}{Q_s(A_d)}$$

Marginal Pro t w.r.t. A_s

$$\frac{@}{@A_s} = v_s \quad P_s \quad \frac{A_s}{Q_s(A_d)} \qquad \frac{A_s}{Q_s(A_d)} P_s^{\theta} \quad \frac{A_s}{Q_s(A_d)}$$

Change in Marginal Pro t w.r.t. A_d

$$\frac{@^2}{@A_s @A_d} = \frac{Q_s^{\theta}(A_d)}{Q_s(A_d)^2} \quad (1 + A_s) P_s^{\theta} \quad \frac{A_s}{Q_s(A_d)} \quad + \quad \frac{A_s}{Q_s(A_d)} P_s^{\theta\theta} \quad \frac{A_s}{Q_s(A_d)}$$

This implies that

$$\frac{@^2}{@A_s @A_d} > 0 \text{ if } P_s^{\theta\theta} \quad \frac{A_s}{Q_s(A_d)} \quad > \quad \frac{1+A_s}{A_s} Q_s(A_d) P_s^{\theta} \quad \frac{A_s}{Q_s(A_d)}$$

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Ad Awareness Investment and Spillovers

We adapt Grossman and Shapiro (1984) to the setting with advertising spillovers. Given

- a unit mass of consumers, uniformly distributed on unit line
- two rms, located on opposite ends of the line
- that if a consumer is aware of a product, he is also knows its price
- that consumers know of a rm if they receive an ad
- that receiving an advertiser's ad also makes the consumer aware of the competitor's product with a certain probability

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Ad Awareness Investment and Spillovers

Let

$_i$ - Fraction of consumers to receive rm i's ad

- Spillover of awareness to competitor from receiving an ad

- Transportation cost

R - Reservation price

$D(\ )$, P, and c - Quantity demanded, unit price, and unit cost, respectively.

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Demand Curve for Firm i's Product

$$D_i(P_i; P_{i0}; \quad _i; \quad _{i0}) = (\quad _i + \quad _{i0}) \quad (1 \quad (\quad _{i0} + \quad _i)) + (\quad _{i0} + \quad _i)\frac{P_{i0} \quad P_i +}{2} \tag{1}$$

Equilibrium Prices and Pro ts

$$P^e = c + \quad 2 \quad (1 + \quad)^{\quad e}$$

$$)^{\quad e}$$

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