Behavioral Advertising and Consumer Welfare

Eduardo Schnadower Mustri, Idris Adjerid, and Alessandro Acquisti

Federal Trade Commission Conference on Marketing and Public Policy, 2024

- Behavioral advertising:
-

- Behavioral advertising:
- Privacy invasive
-

- Behavioral advertising:
- Privacy invasive
- But good for consumer welfare

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Digital Advertising Business Guidance Request for Information

Posted by the **Federal Trade Commission** on Jun 3, 2022

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August 2, 2022

Federal Trade Commission
Office of the Secretary
600 Pennsylvania Avenue, NW
Suite CC-5610 (Annex B)
Washington, DC 20580

RE: Request for Information on Digital Advertising Guidelines, P114506

For decades, digital advertisements have powered the growth of online services by supporting and subsidizing publishers that provide free and low-cost services to consumers. Not only has this enabled consumers to experience a wide variety of online services, but it also has delivered significant intrinsic monetary value to consumers. For instance, an economic analysis published by researchers from the Massachusetts Institute of Technology ("MIT") found that

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- Johnson et al (2024)
- …

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- …

vs

- Lefrere et al (2024): No significant effect of GDPR on EU news/media websites' content quantity and quality
- Cheyre et al (2024): Negligible (and only temporary) effect on ATT on availability and quality of apps in the iOS ecosystem
- …

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- Value: indirect and direct

Do consumers benefit from behavioral ads?

- Claim: behaviorally targeted ads provide relevant products and services, saving consumers time and money

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- But that tells us mainly about *search costs* – not net consumer utility
  - Little is known about relationship b/n behavioral advertising and other variables (e.g. vendor quality, product price, …) that also affect consumer welfare
  - Large body of empirical work on online advertising – but limited focus on consumers
    - Most recent consumer-oriented studies focus on search advertising or on platform/campaign-specific ads (e.g Sahni & Zhang 2023, Wan et al 2023, Lee & Musolff 2023, Farronato et al. 2023, and Yu 2024)

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- To understand the impact of behavioral advertising on consumer welfare, we need a holistic, counterfactual empirical approach
  - Two online pre-registered experiments
    - Study 1 (n = 487)
    - Study 2 (n = 490)

This paper

- Focus
  - Compare
    - Objective product/vendor metrics (e.g. vendor quality, product price)
    - Self-reported product/vendor metrics (e.g. participants' perceived novelty, perceived relevance)
- Two online pre-registered experiments
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    - Objective product/vendor metrics (e.g. vendor quality, product price)
    - Self-reported product/vendor metrics (e.g. participants' perceived novelty, perceived relevance)
  - Across:

Design

1. Products behaviorally targeted to participants (via display ads), vs
2. Competitor products from online searches (organic products; google.com), vs 3. Random products

Stage 1: Ad URL Collection

- RAs collect basic information from the ads: **price, website, brand, description, product category.**

Intermediate Stage

- RAs search for similar products.
- Participants are presented with a **up to 9 products** in randomized order: one for

Stage 2: Questionnaire

each valid ad they provided, and their

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randomly assigned products and are asked questions about their preference.

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A man who died after self-immolating in front of Supreme Court was a climate activist

News and buzz

Sharon Osbourne says recent facelift made her look like a 'Cyclops'

FAA investigating plane-swap stunt that resulted in crash 23 m

Video shows pilots switching planes mid-air, one crash lands 1 h

US labor board sues Starbucks to rehire unionizing employees 4 h

Chevrolet Corvette is officially going electric

See thousands of impounded luxury cars at port parking lot

How 15 minutes of mental health hygiene can change your whole day

A quarter of all the electricity in this county is powering Bitcoin mining

How to get free fries at Burger King

World's oldest person dies at age 119

Content by Dashlane
Why securing businesses starts with passwords

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Family members of Covid-19 ICU patients may emerge with a different condition, study says

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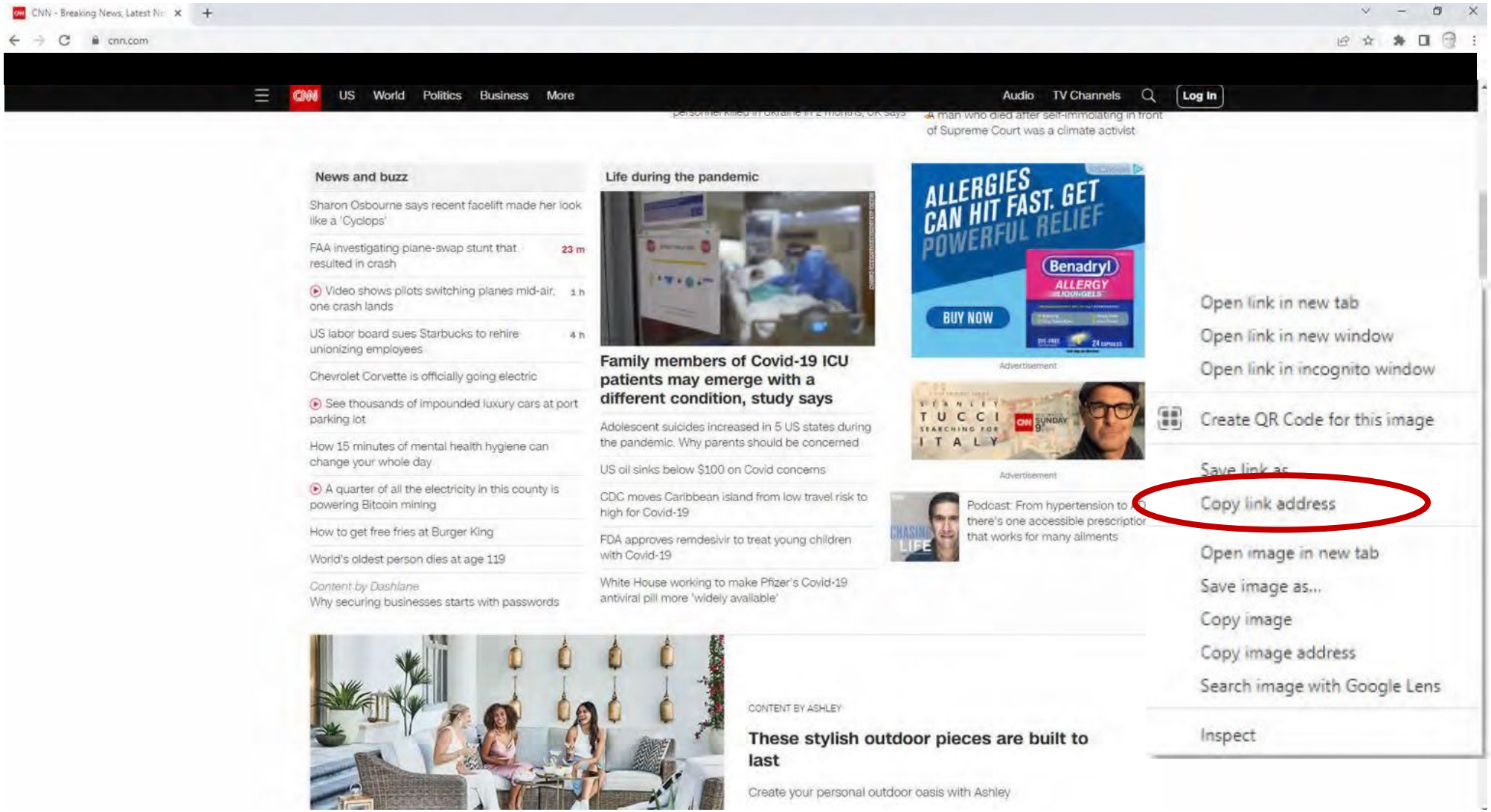
CDC moves Caribbean island from low travel risk to high for Covid-19

FDA approves remdesivir to treat young children with Covid-19

White House working to make Pfizer's Covid-19 antiviral pill more 'widely available'

Podcast: From hypertension to ADHD, there's one accessible prescription that works for many ailments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White House working to make Pfizer's Covid-19 antiviral pill more 'widely available'
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ALLERGY
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Inspect

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https://www.benadryl.com/products/benadryl-allergy-dye-free-liquigels

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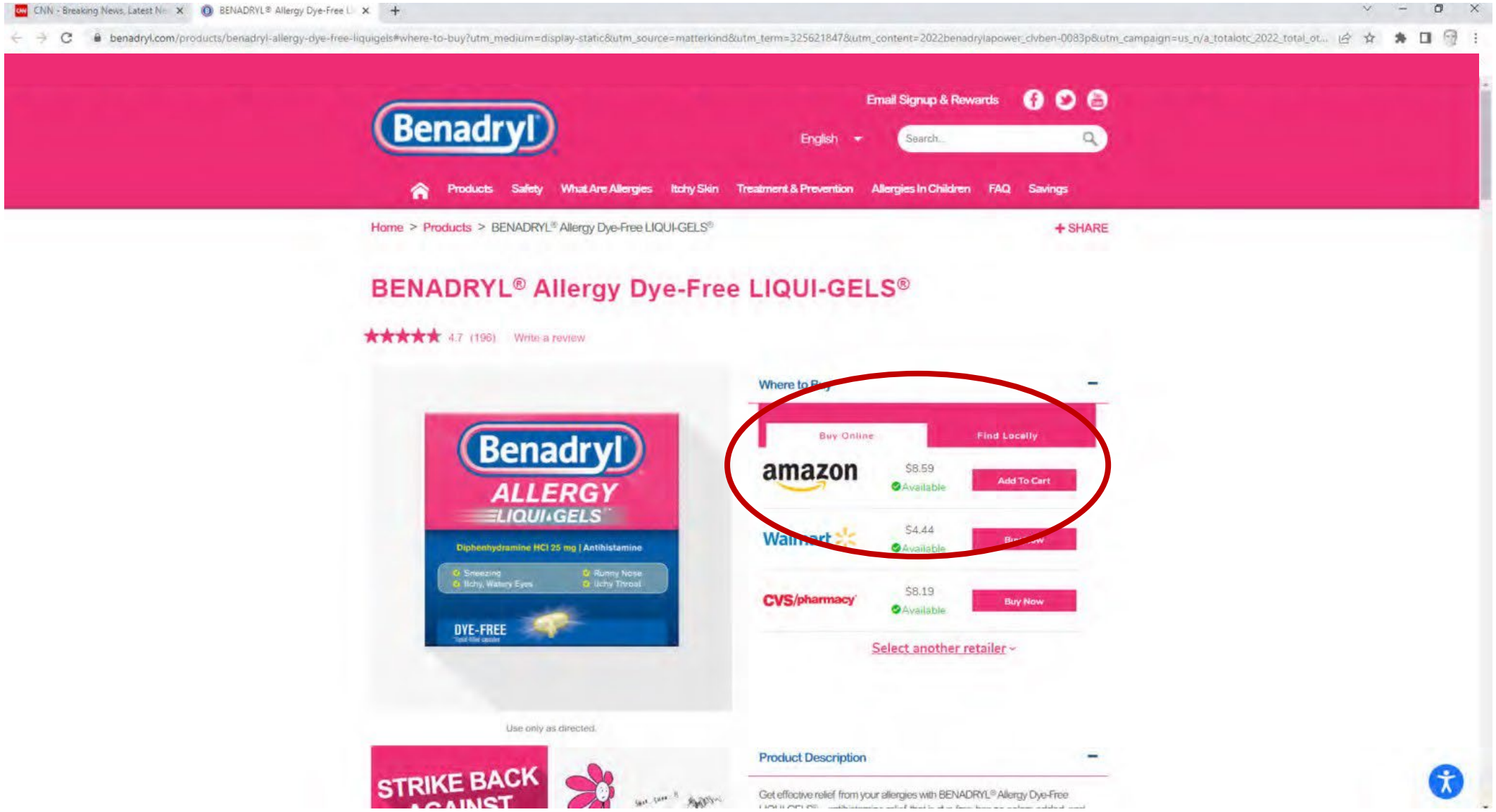
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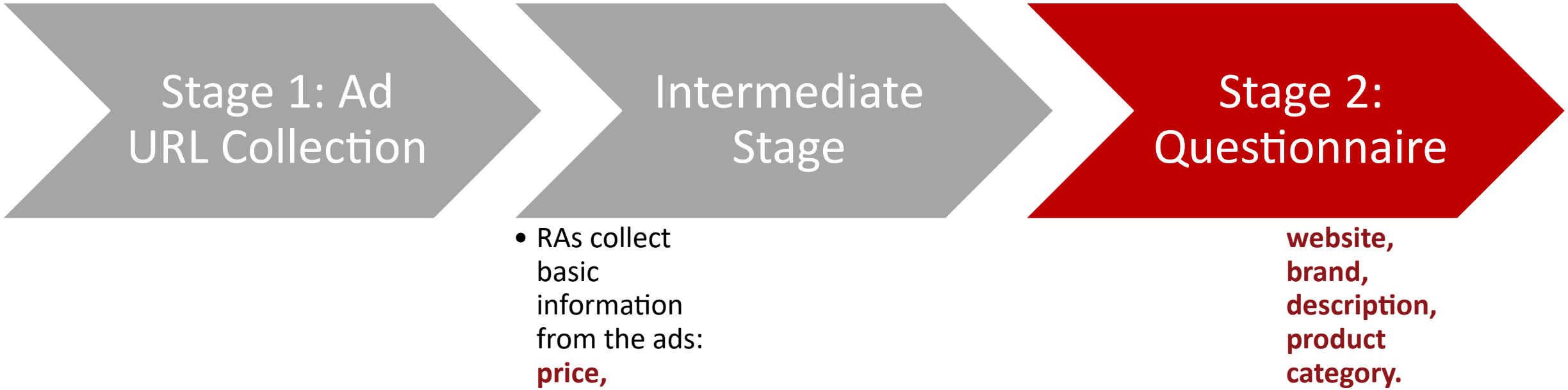
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Three conditions within-subject

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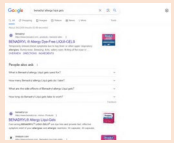
Three conditions within-subject

Behaviorally targeted product (display ad)



Competitor product (organic search result)

Random product

Random product

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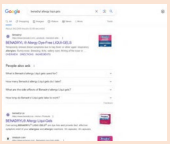
Objective product



Competitor product (organic search result)

- and vendor metrics
- Self-reported

product and vendor metrics Behaviorally

roduct

targeted product (display ad)

- Objective product and vendor metrics

Competitor product (organic search result)

Three conditions within-subject

Table 1. Distribution of BBB Ratings by study and experimental condition.

(A) Study 1		
Grade	Ad (%)	Search (%)
A+ to B-	671 (57%)	881 (75%)
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Total	1169 (100%)	1169 (100%)

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Table 2. Descriptive statistics for logs of prices by study and experimental condition.

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Type	Min	Max	Mean	St. Dev	Median
Ad	-1.83	10.37	4.15	1.69	3.89
Search	-2.20	10.40	4.05	1.59	3.78
Total	**-2.20**	**10.40**	**4.11**	**1.64**	**3.82**

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Table 3. Summary of price comparison results for identical products by study.

Measure	Study 1
Products with no price dispersion	15.73%
The lowest price was in Search	52.16%
The lowest price was in Ad	32.11%
Total	**100%**

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Summary (so far)

- Study 1 results were surprising
  - Products displayed in behaviorally targeted ads were associated higher prices and lower-quality vendors relative to competitor products in Search results
  - But, why?

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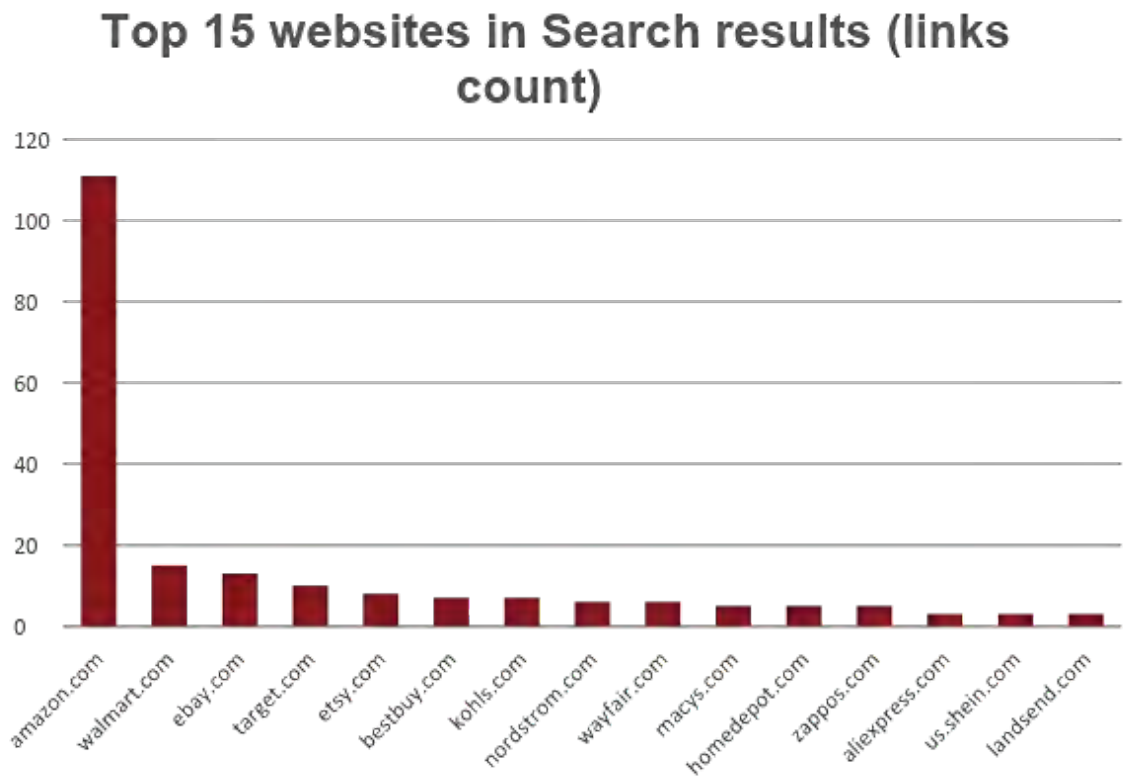
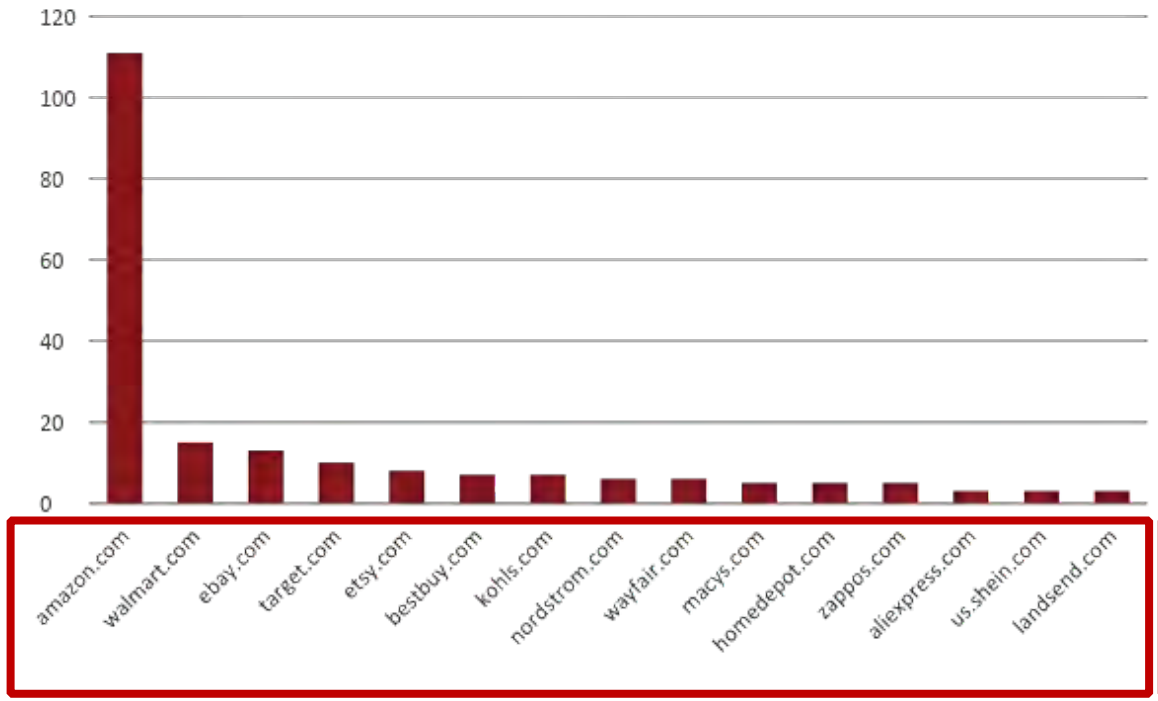
- *Post hoc* conjecture: Varian 1980 (“A model of sales”)

Vendors distribution



Top 15 websites in Search results (links count)



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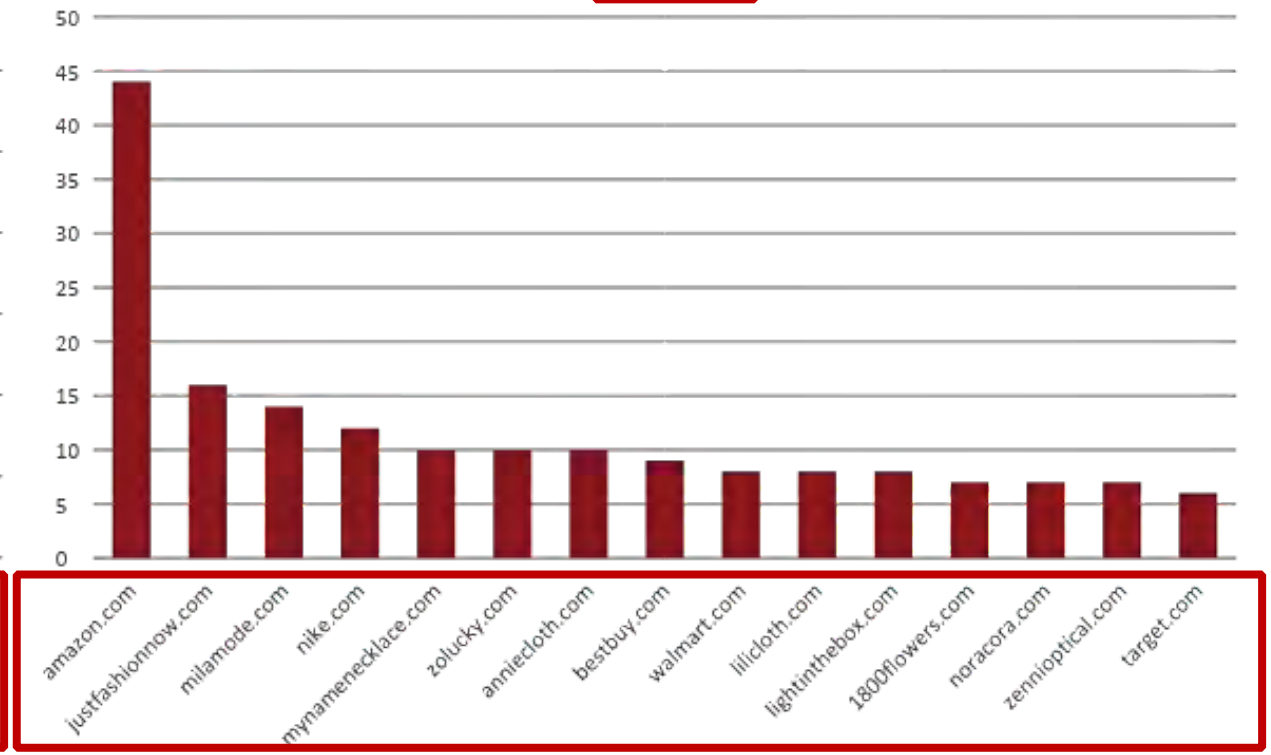

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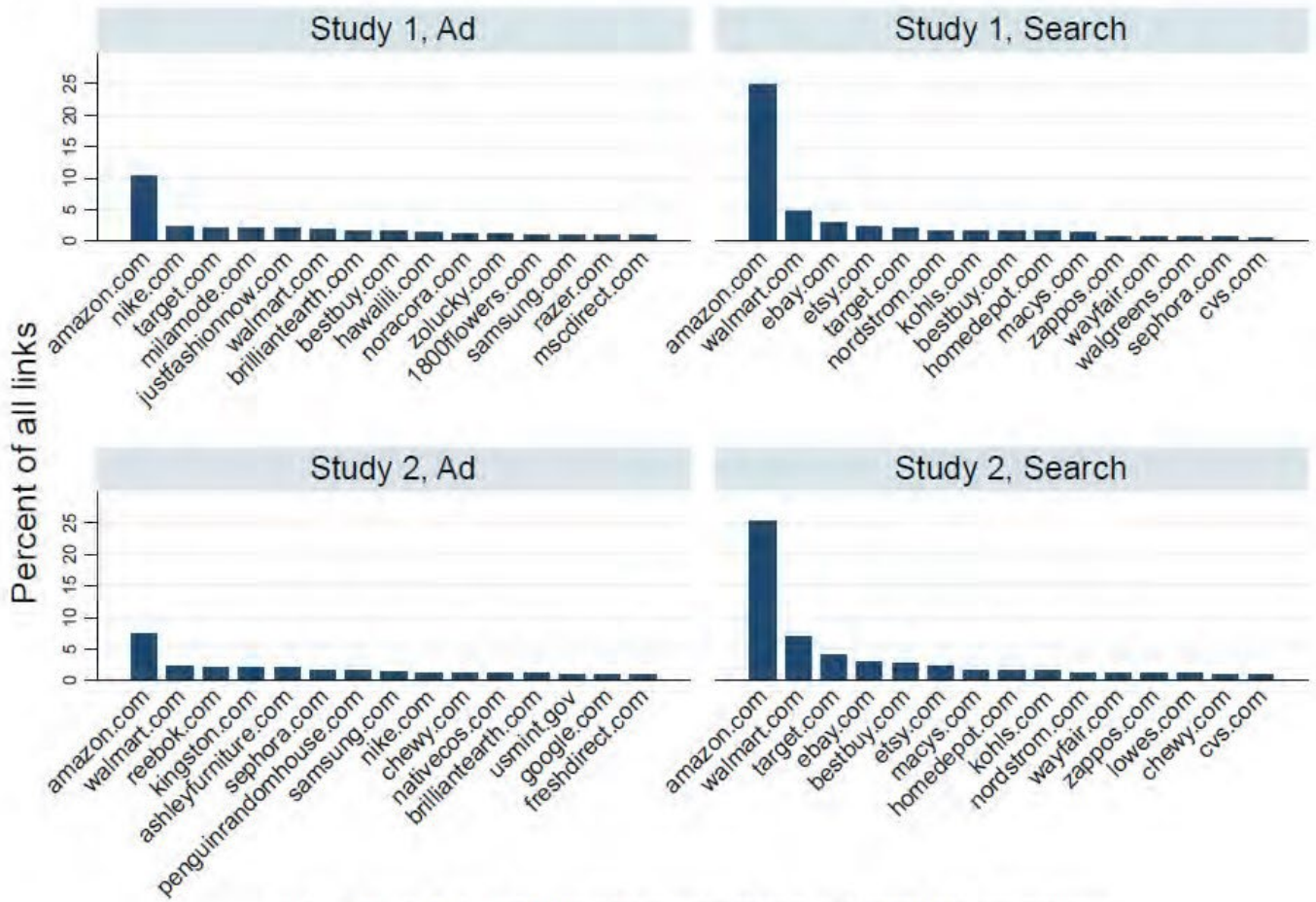
Figure 1. Distribution of the top 15 vendors across studies and experimental conditions.



Notes. N for study 1 = 1169 links per condition; N for study2 = 1185 links per condition.

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(B) Study 2		
Grade	Ad (%)	Search (%)
A+ to B-	700 (59%)	944 (80%)
C+ to D-	71 (6%)	48 (4%)
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Search	0.00	10.96	4.28	1.69	4.05
Total	**-1.31**	**13.76**	**4.41**	**1.80**	**4.22**

Note. Random condition is not shown, as random products were drawn from ads seen by other participants; therefore, prices in the random condition come from the same distribution.

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Total	**-2.20**	**10.40**	**4.11**	**1.64**	**3.82**
(B) Study 2					
Type	Min	Max	Mean	St. Dev	Median
Ad	-1.30	13.76	4.53	1.89	4.37
Search	0.00	10.96	4.28	1.69	4.05
Total	**-1.31**	**13.76**	**4.41**	**1.80**	**4.22**

Note. Random condition is not shown, as random products were drawn from ads seen by other participants; therefore, prices in the random condition come from the same distribution.

Study 2: Prices (identical products only)

Table 3. Summary of price comparison results for identical products by study.

Measure	Study 1	Study 2
Products with no price dispersion	15.73%	21.25%
The lowest price was in Search	52.16%	48.71%
The lowest price was in Ad	32.11%	30.04%
Total	**100%**	**100%**

Additional results

Table 3. Summary of price comparison results for identical products by study.

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Additional results

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- Latent Utility Analysis (LUA): $welfare_{search} > welfare_{targeted}$

Additional results

- Results robust to multiple specifications (including regressions controlling for product F.E., vendor F.E., participants characteristics, ….)
- Latent Utility Analysis (LUA): $\text{welfare}_{\text{search}} > \text{welfare}_{\text{targeted}}$
- Behaviorally targeted ads are associated with higher relevance relative to random products (Study 1)
- But effect goes away after controlling for participants' prior product searches (Study 2)

 Display ads, Google search, Chrome

Limitations

- Results may not extend to social media ads or ads on other platforms (e.g. Amazon), or mobile ads

Thank you

- Search results heavily dominated by large vendors - barrier to entry for small sellers, which can use behavioral display ads to reach consumers
- Behaviorally targeted ads associated with higher prices, and lower quality vendors, relative to search results
- Do behavioral ads meaningfully reduce search costs? Unclear

- SSRN: Alessandro Acquisti ▪ Bing/Google: economics of privacy
- www.heinz.cmu.edu/~acquisti/

Extra slides

"Behavioural targeting is not only good for consumers […] it's a rare win for everyone. […] It ensures that ad placements display content that you might be interested in rather than ads that are irrelevant and uninteresting. […] Advertisers achieve […] a greater chance of selling the product. Publishers also win as […] behavioral targeting increases the value of the ad placements."

David Nelson, Operations & IT Director, Unanimis.co.uk, 2013

“Behavioural

Extra extra slides

David Nelson, Operations & IT Director, Unanimis.co.uk

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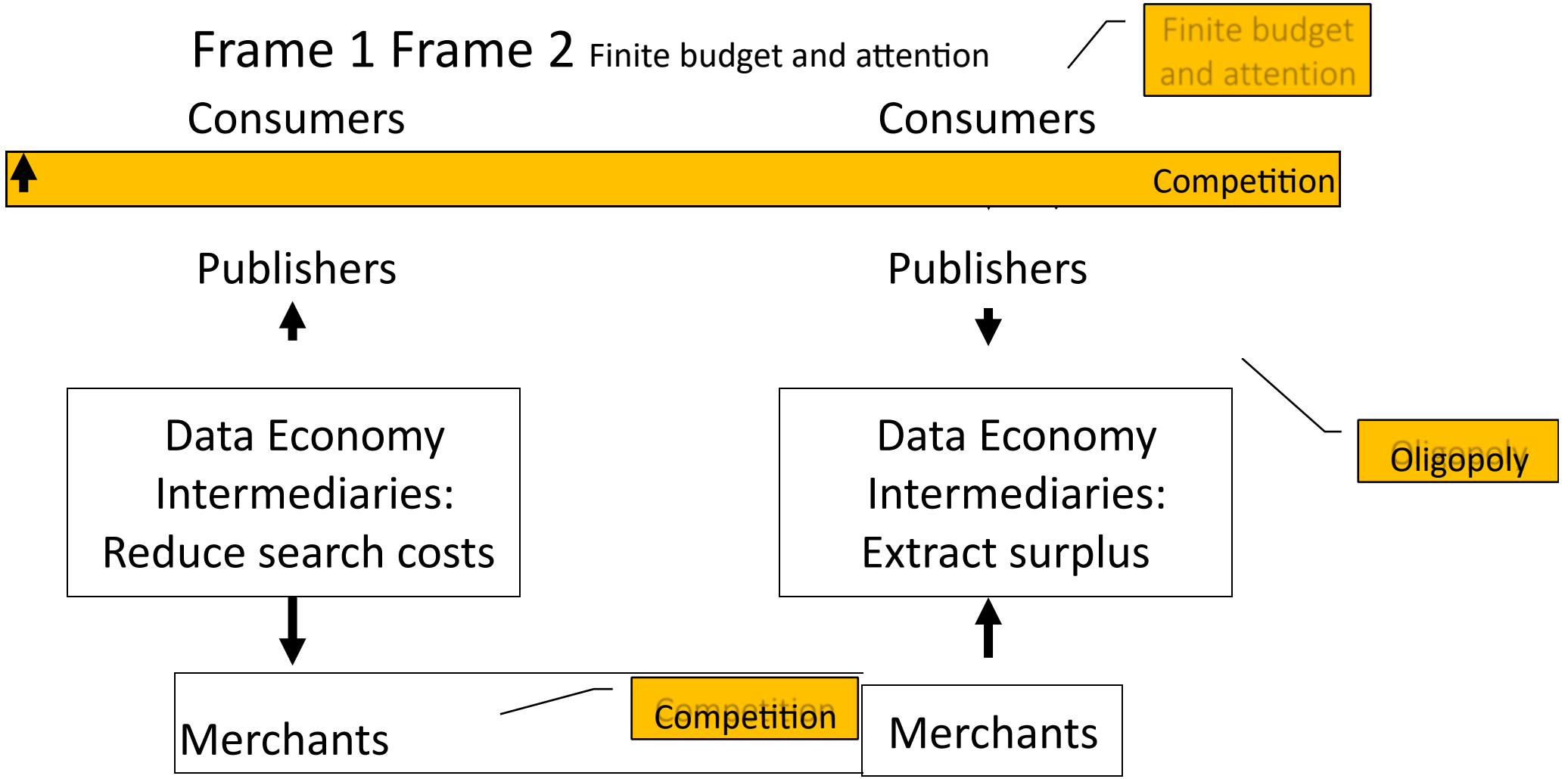
Online advertising: Online advertising:

"Behavioural



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Motivation

- The value consumers derive from OBA (online behavioral advertising) is more often posited than empirically demonstrated
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Motivation

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- The value consumers derive from OBA (online behavioral advertising) is more often posited than empirically demonstrated
- Value: indirect and direct
-

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Motivation

- Value: indirect and direct
-

Motivation

- The value consumers derive from OBA (online behavioral advertising) is more often posited than empirically demonstrated
- Value: indirect and direct
- For instance: Janssen et al (2022) vs
- Lefrere et al (2022); Cheyre et al (2023)

- The value consumers derive from OBA (online behavioral advertising) is more often posited than empirically demonstrated

Motivation

- Value: indirect and direct
-
-
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-

Motivation

- The value consumers derive from OBA (online behavioral advertising) is more often posited than empirically demonstrated
- Value: indirect and direct
- Industry: OBA provides relevant products and services, saving time and money (Dehling et al, 2019)
  - Behaviorally targeted ads *do* tend to receive higher click-through rates than non targeted ones

- But that tells us about *search costs* – not net consumer utility
- Little is known about the relationship OBA has with factors such as quality, price, or novelty of product offers, which may also affect consumers' enjoyment of a product
- Most studies are not designed to address this question, because they take an ad campaign-centric perspective

Motivation

- E.g., Yan et al, 2009, Bart et al, 2012, Bleier, & Eisenbeiss, 2015, Van Doorn & Hoekstra, 2013 – among many others
- To better understand the impact of OBA on consumer welfare, we need a counterfactual approach that takes a consumer-centric perspective: comparing various components of consumer utility across alternative online offers consumers may find online
- E.g., price, product quality, vendor quality, and so forth

- Consumer welfare may increase thanks to OBA through better matching (Esteban & Hernandez, 2007; Gal-Or & Gal-Or, 2005)
- However, prices may be higher under targeting for subsets of consumers (Iyer et al, 2005; Esteban & Hernandez, 2007; Gal-Or & Gal-Or, 2005)
- In fact, consumer welfare may be decreased by OBA if consumer's reservation prices are revealed (Marotta et al, 2021; Varian, 1996)

- Furthermore, vendors with lower profit margins may have an incentive to target less accurately (Acquisti, 2014)
- Welfare may also be decreased by OBA due to annoyance and privacy concerns (Johnson 2013; Gal-Or et al, 2018)

- OBA can increase click-through rates (Bleier, & Eisenbeiss, 2015; Yan et al, 2009), purchase intentions (Van Doorn & Hoekstra, 2013; Bart et al, 2012), purchase probability (Manchanda et al, 2006;

Lewis & Reily, 2009)

- Although obtrusiveness, intrusiveness and interruptions can decrease ad performance (Goldfarb & Tucker, 2011b; Van Doorn & Hoekstra, 2013; Bart et al, 2012; Acquisti & Spiekerman, 2011; Duff & Faber, 2011)

- Ad-blockers can decrease spending for unfamiliar brands, shifting spending towards familiar brands (Todri, 2020)

- However: none of these studies are designed to investigate how price, quality, and other product features in behaviorally targeted ads compare to alternatives in the market

- Two online experiments
- Study 1 (n = 487)
- Study 2 (n = 490) (Replication and extension)
- Pre-registered
- Focus

- We compare “objective” product/vendor metrics (e.g. vendor quality, product price, and so forth) as well as participants’ “self-reported” product/vendor metrics (e.g. perceived novelty, perceived relevance, and so forth) for products that were behaviorally targeted to participants, vs competitor products found via online searches, vs random products

Experimental design

brand , descri ption,

product category.

- RAs search for similar products.

assigned products and are asked questions about their preference.

Experimental design

Stage 1: Ad URL Collection

Intermediate Stage

- RAs collect basic information from the ads: price, website,

Stage 2: Questionnaire

preference.

Experimental design

with a up to 9 products in randomized order: one for each valid ad they provided,

and their respective competitors and randomly

assigned products and are asked questions about their preference.

Experimental design

sites selected based on criteria brand, description, product from Balebako et al, 2012) category.

assigned products and are asked questions about their preference.

Experimental design

- RAs search for similar products.

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Experimental design

- Participants visit randomly selected websites (from pool of up to

- RAs collect basic information from the ads: price, website,

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products in randomized order: one for each valid ad they provided, and their respective competitors and randomly

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Experimental design

Stage 1: Ad URL Collection

- Participants visit randomly selected websites (from pool of sites selected based on criteria from Balebako et al, 2012)
- Participants use the experiment interface to collect and submit URLS for ads displayed to them (focus: physical products)

Intermediate Stage

- RAs collect basic information from the ads: price, website, brand, description, product category.
- RAs search for similar products.
- Participants are presented with a up to 9 products in

Stage 2: Questionnaire

randomized order: one for each valid ad they provided, and their respective competitors and randomly

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personnel killed in Ukraine in 2 months, UK says

A man who died after self-immolating in front of Supreme Court was a climate activist

News and buzz

Sharon Osbourne says recent facelift made her look like a 'Cyclops'

FAA investigating plane-swap stunt that resulted in crash 23 m

Video shows pilots switching planes mid-air, one crash lands 1 h

US labor board sues Starbucks to rehire unionizing employees 4 h

Chevrolet Corvette is officially going electric

See thousands of impounded luxury cars at port parking lot

How 15 minutes of mental health hygiene can change your whole day

A quarter of all the electricity in this county is powering Bitcoin mining

How to get free fries at Burger King

World's oldest person dies at age 119

Content by Dashlane
Why securing businesses starts with passwords

Life during the pandemic

Family members of Covid-19 ICU patients may emerge with a different condition, study says

Adolescent suicides increased in 5 US states during the pandemic. Why parents should be concerned

US oil sinks below $100 on Covid concerns

CDC moves Caribbean island from low travel risk to high for Covid-19

FDA approves remdesivir to treat young children with Covid-19

White House working to make Pfizer's Covid-19 antiviral pill more 'widely available'

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Advertisement

Advertisement

Podcast: From hypertension to AD there's one accessible prescription that works for many ailments

CONTENT BY ASHLEY

These stylish outdoor pieces are built to last

Create your personal outdoor oasis with Ashley

Open link in new tab
Open link in new window
Open link in incognito window
Create QR Code for this image
Save link as...
Copy link address
Open image in new tab
Save image as...
Copy image
Copy image address
Search image with Google Lens
Inspect

Experimental design

- How do we ensure that ads served to our sample of participants have high likelihood of being behaviorally targeted?

Pre-, during-, post-study checks

1. Pre-study analysis and selection of websites
2. During-study recruitment (Chrome)
3. During-study automated scripts and survey
4. Post-study analysis

Experimental design

Stage 1: Ad URL Collection

- Participants visit randomly selected websites (from pool of sites selected based on criteria from Balebako et al, 2012)
- Participants use the experiment interface to collect and submit URLS for ads displayed to them

Intermediate Stage

- Scripts+RAs use URLS to collect objective metrics for products (focus: physical products)

and vendors associated with ads

Stage 2: Questionnaire

- Participants are presented with a up to 9 productsin randomized

order: one for each valid ad they provided, and their respective competitors and randomly assigned products and are asked questions about their preference.

Experimental design

- Are products and prices collected through our scripts the same as those that would have been shown to participants?
- In a nutshell, yes

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Copy link address
Open image in new tab
Save image as...
Copy image
Copy image address
Search image with Google Lens
Inspect

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benadryl.com/products/benadryl-allergy-dye-free-liquigels#where-to-buy?utm_medium=display-static&utm_source=matterkind&utm_term=325621847&utm_content=2022benadrylapower_clvben-0083p&utm_campaign=us_n/a_totalotc_2022_total_ot...

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BENADRYL® Allergy Dye-Free LIQUI-GELS®

★★★★★ 4.7 (196) Write a review

Use only as directed.

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Buy Online | Find Locally

amazon	$8.59 Available	Add To Cart
Walmart	$4.44 Available	Buy Now
CVS/pharmacy	$8.19 Available	Buy Now

Select another retailer

Product Description

Get effective relief from your allergies with BENADRYL® Allergy Dye-Free

STRIKE BACK

Stage 1: Ad URL Collection

- Participants visit randomly selected websites (from pool of sites selected based on criteria from Balebako et. al, 2012)

Intermediate Stage

- Participants use the experiment interface to collect and submit URLS for ads displayed to them (focus: physical products)

Stage 2: Questionnaire

- Scripts+RAs use URLS to collect objective metrics for products and vendors associated with ads

Stage 1: Ad URL Collection

- Scripts+RAs search (Google) for the same products, and collect objective metrics for those sold by competitor vendors
- Participants are presented with three triads of products (total 9 products) in randomized order. "Subjective metrics" for each

Intermediate Stage

product are captured through a questionnaire • Each triad

consists in:

- One "Ad" product
- One "Search" (competitor) product
- One "Random" product

Stage 2: Questionnaire

- Participants visit randomly selected websites (from pool of sites selected based on criteria from Balebako et. al, 2012)
- Participants use the experiment interface to collect and submit URLS for ads displayed to them (focus: physical products)

- Scripts+RAs use URLS to collect objective metrics for products and vendors associated with ads
- Scripts+RAs search (Google) for the same products, and collect objective metrics for those sold by competitor vendors
- Participants are presented with three triads of products (total: 9 products) in randomized order. Subjective metrics for each product are captured through a questionnaire • Each triad consists in:
- One “Ads” product
- One “Search” product
- One “Random” product

- For each participant, we compare objective and subjective product/vendor metrics across three conditions

“Ads” products

- From the landing pages the participants would have seen had clicked on the ad

 Objective metrics

- Vendor name
- Vendor industry
- Vendor quality (BBB, SiteJabber)
- Product type
- Product description
- Product price (from product page)
- Self-reported metrics (1-7 Likert scales from marketing, economics, and information systems literatures)
- Perceived product quality
- Perceived price fairness
- Perceived relevance
- Perceived novelty/familiarity with vendor, product, and brand

- Purchase intention
- Four measures (PI1, PI2, PI3, PI4) and their composite

Results

- Study 1
- Descriptive statistics
- Study 2 (Replication and extension)
- Descriptive statistics
- Latent utility analysis (LUA)

Study 1: Participants

- N = 487 (Prolific); Spring/Summer 2021
- Provided 1,169 valid ad links, leading to 3,507 data points
- US based (39 States)
- Gender: 41% F

- Age: Min 18, Max 75, Mean 36 (11.44)
- 91% have at least a degree, 9% completed high school. 56% are full time employees, 15% are students
- 91 participants had ad blockers, 22 TOR or VPN; 70 used opt-outs; 115 used at least one kind of privacy technology

Table 1. Distribution of BBB Ratings by study and experimental condition.

(A) Study 1		
Grade	Ad (%)	Search (%)
A+ to B-	671 (57%)	881 (75%)
C+ to D-	65 (5%)	57 (5%)
F	224 (20%)	71 (6%)
NR/NOT FOUND	209 (18%)	160 (14%)
Total	1169 (100%)	1169 (100%)

$\chi^2(3)=73.71$, $p<0.001$

Study 1: Prices

SiteJabber results confirm BBB results: average rating of websites in Ads (M=3.41, SD=1.09) was inferior to that for websites in Search results (M=3.54, SD=0.90) ($p<0.01$)

Table 2. Descriptive statistics for logs of prices by study and experimental condition.

(A) Study 1					
Type	Min	Max	Mean	St. Dev	Median
Ad	-1.83	10.37	4.15	1.69	3.89
Search	-2.20	10.40	4.05	1.59	3.78
Total	**-2.20**	**10.40**	**4.11**	**1.64**	**3.82**

- Of the 1,169 original ads, 635 were for products that were sold by multiple vendors
- For that subset, we can directly compare prices

Table 3. Summary of price comparison results for identical products by study.

Measure	Study 1
Products with no price dispersion	15.73%
The lowest price was in Search	52.16%
The lowest price was in Ad	32.11%
Total	**100%**

- Average price saving from conducting a product search is roughly 10% ($p<0.001$)

- Products were, on average, not very relevant, even in the Ad condition

- There is no difference in relevance between ad and competitor, but the random is significantly less relevant

Condition	Mean (St. Dev)
Ad	4.01 (2.05)
Competitor	3.94 (2.08)
Random	3.58 (1.98)

Statistical test	Value (std. error)
RMAnova F	23.76**
Contrast (Ad vs Competitor)	-0.06 (0.11)
Contrast (Ad vs Random)	-0.43** (0.11)

* P < 0.05, ** P < 0.01

- Perceived quality of the product is just above the median Likert value
- Values are similar across conditions

Condition	Mean (St. Dev)
Ad	4.81 (1.32)
Competitor	4.70 (1.24)
Random	4.68 (1.21)

Statistical test	Value (std. error)
RMAnova F	2.06
Contrast (Ad vs Competitor)	-0.11 (0.07)
Contrast (Ad vs Random)	-0.13 (0.07)

* $P < 0.05$, ** $P < 0.01$

Condition	Product type Mean (St. Dev)	Vendor Mean (St. Dev)	Brand Mean (St. Dev)
Ad	5.00 (1.85)	3.42 (2.48)	3.11 (2.34)
Competitor	4.93 (1.82)	4.19 (2.56)	2.78 (2.23)
Random	4.51 (2.06)	3.00 (2.34)	2.83 (2.21)

Statistical test	Value (std. error)	Value (std. error)	Value (std. error)
RMAnova F	13.27**	29.27**	3.26*

Contrast (Ad vs Competitor)	-0.05 (0.1)	0.78** (0.16)	-0.33* (0.14)
Contrast (Ad vs Random)	-0.48** (0.1)	-0.40* (0.16)	-0.27* (0.14)

* P < 0.05, ** P < 0.01

- Price fairness was slightly above the neutral point
- We observe no significant differences between the ads and the other conditions
- The High Anova F value comes from the difference between Competitor and Random: 0.37** (0.11)

Condition	Mean (St. Dev)
Ad	4.45 (1.85)
Competitor	4.66 (1.77)
Random	4.29 (1.81)

Statistical test	Value (std. error)
RMAnova F	5.31**
Contrast (Ad vs Competitor)	0.20 (0.11)
Contrast (Ad vs Random)	-0.16 (0.11)

* P < 0.05, ** P < 0.01

- Purchase intentions are, on average, low
- They are not different between ad and competitor but are significantly lower for the random condition
- Random ads were therefore less relevant (as expected)

Condition	Mean (St. Dev)
Ad	3.16 (1.86)
Competitor	3.05 (1.78)
Random	2.79 (1.72)

Statistical test	Value (std. error)
RMAnova F	15.84**
Contrast (Ad vs Competitor)	-0.10 (0.09)
Contrast (Ad vs Random)	-0.37** (0.09)

* P < 0.05, ** P < 0.01

Variable/Contrast Ads vs	Search	Random
Purchase intention	Negative	Negative**
Price fairness	Positive	Negative
Perceive product quality	Negative	Negative
Relevance	Negative	Negative**
Familiarity with product type	Negative	Negative**
Familiarity with vendor	Positive**	Negative*
Familiarity with brand	Negative*	Negative*

* P < 0.05, ** P < 0.01

Vendors from Search results are more popular. Ads enable smaller vendors to gain visibility

However, they present brands that are more familiar to participants

Price fairness and perceived quality of product are similar across conditions

Random products have lower purchase intentions, relevance, and familiarity than Ad products

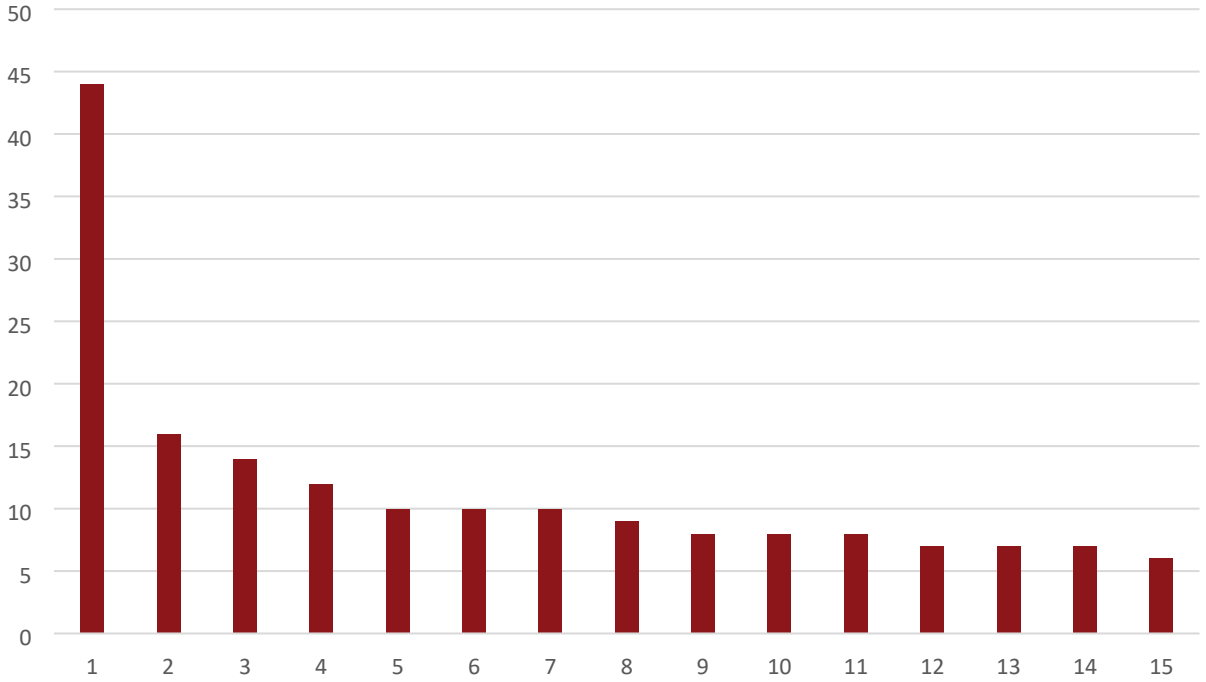
Note: Products in the Ad condition are not “more” relevant, but rather slightly less irrelevant (Mean_Ad 1-7 Likert: 4.01 [2.05])

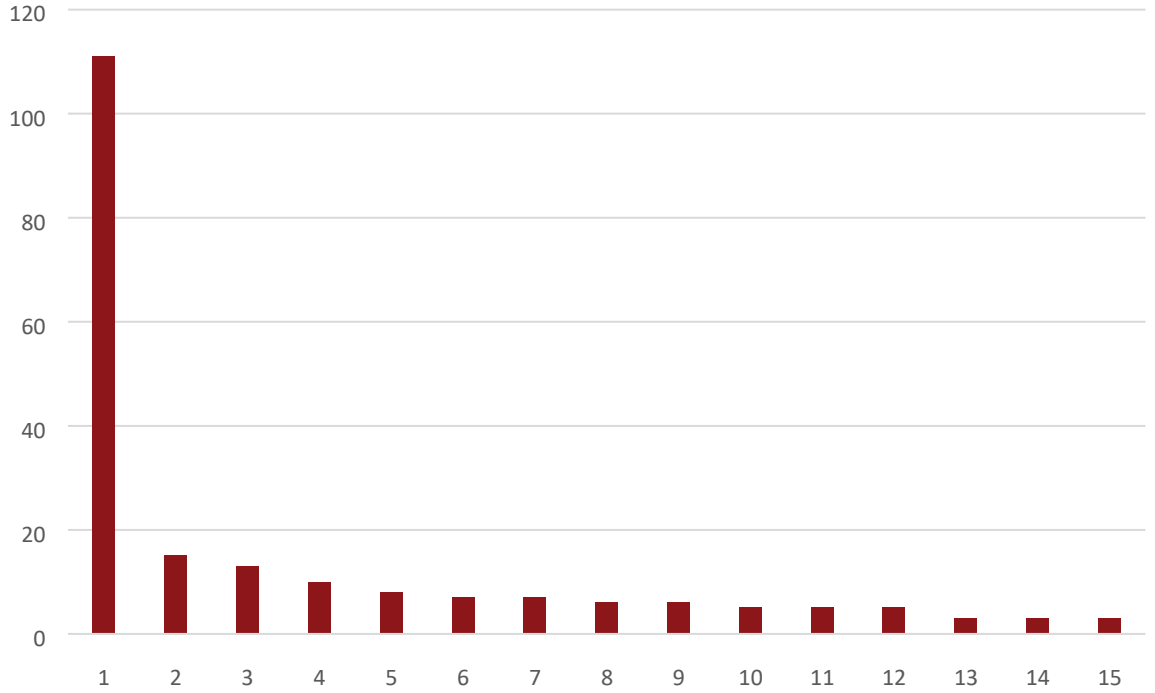
From Study 1 to Study 2

- Some Study 1 results were surprising
- Products displayed in targeted ads were associated with higher purchase intentions, relevance, and familiarity relative to Random (*not surprising*), but not to Search
- However, they also tended to be associated with higher prices and lower-quality vendors But, why?

Top 15 websites in Ads (links count)

Top 15 websites in Search results (links count)





Highly skewed distributions in both displayed Ad and Search results

Log monthly visits of websites that appeared in Ads (M=15.68, SD=3.05) are much lower than those in Search results (M=17.75, SD= 3.34): $t(801) = -9.16$, $p < 0.001$)

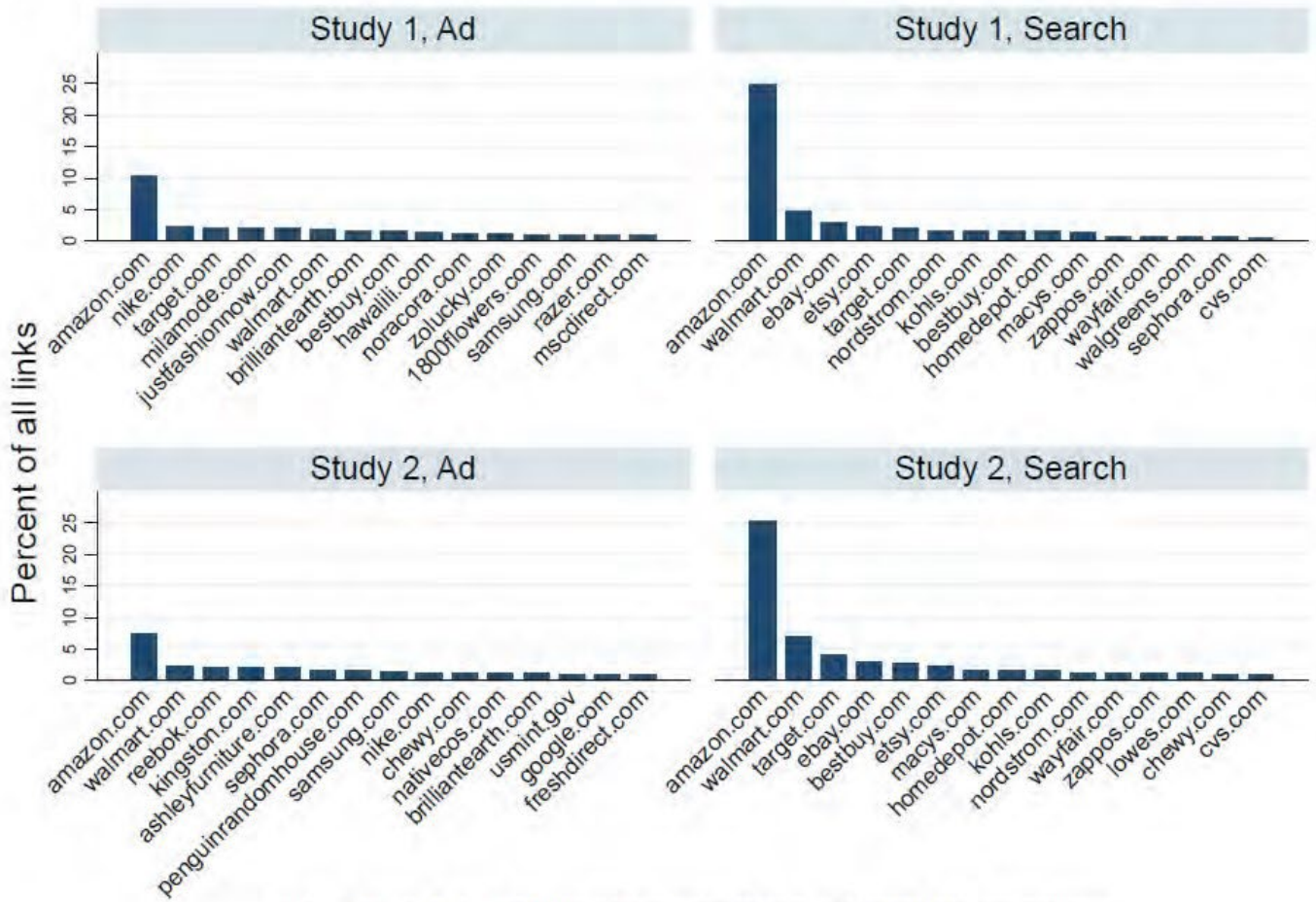
- Some Study 1 results were surprising
- Products displayed in targeted ads were associated with higher purchase intentions, relevance, and familiarity relative to Random (*not surprising*), but not to Search
- However, they also tended to be associated with higher prices and lower-quality vendors But, why?
- Possible interpretation (post hoc): separating equilibrium *a la* Varian (1980)'s "model of sales," generated by high competition in search
- Are the results robust? Do participants take into account vendor quality when expressing purchase intentions? If they do, how does that affect their (latent) utility?
- Study 2
- Replication (same design, new sample) Extension:
- Asked participants purchase intentions both before and after providing vendor ratings

- Added extra question: whether participant had searched for the product advertised to them in the past 4 weeks

Study 2

- N = 490 (Prolific, US-based sample); Spring 2022
- Study 1 results wholly replicated

Figure 1. Distribution of the top 15 vendors across studies and experimental conditions.



Notes. N for study 1 = 1169 links per condition; N for study2 = 1185 links per condition.

Table 1. Distribution of BBB Ratings by study and experimental condition.

(A) Study 1		
Grade	Ad (%)	Search (%)
A+ to B-	671 (57%)	881 (75%)
C+ to D-	65 (5%)	57 (5%)
F	224 (20%)	71 (6%)
NR/NOT FOUND	209 (18%)	160 (14%)
Total	1169 (100%)	1169 (100%)
(B) Study 2		
Grade	Ad (%)	Search (%)
A+ to B-	700 (59%)	944 (80%)
C+ to D-	71 (6%)	48 (4%)
F	175 (15%)	71 (6%)
NR/NOT FOUND	239 (20%)	122 (10%)
Total	1185 (100%)	1185 (100%)

Table 2. Descriptive statistics for logs of prices by study and experimental condition.

(A) Study 1					
Type	Min	Max	Mean	St. Dev	Median
Ad	-1.83	10.37	4.15	1.69	3.89
Search	-2.20	10.40	4.05	1.59	3.78
Total	**-2.20**	**10.40**	**4.11**	**1.64**	**3.82**
(B) Study 2					
Type	Min	Max	Mean	St. Dev	Median
Ad	-1.30	13.76	4.53	1.89	4.37
Search	0.00	10.96	4.28	1.69	4.05
Total	**-1.31**	**13.76**	**4.41**	**1.80**	**4.22**

Note. Random condition is not shown, as random products were drawn from ads seen by other participants; therefore, prices in the random condition come from the same distribution.

Study 2: Prices (identical products only)

Table 3. Summary of price comparison results for identical products by study.

Measure	Study 1	Study 2
Products with no price dispersion	15.73%	21.25%
The lowest price was in Search	52.16%	48.71%
The lowest price was in Ad	32.11%	30.04%
Total	**100%**	**100%**

Study 2: Other results

- Self-reported metrics: Patterns in Study 1 results confirmed
- Both higher relevance and purchase intention for Ads products (relative to random) disappear after controlling for participants' prior searches

- When provided information about vendor quality, participants' purchase intentions change (lower quality vendors are associated with lower purchase intentions)

- Assume that measures of purchase intentions are driven by latent, unobserved utility
- Assume that a participant expresses a positive intention to purchase if her expected (unobserved) utility is >0
- As price fairness, quality, familiarity, relevance, vendor quality, etc. have been shown to influence purchase intentions (Dursun et al, 2011; Laroche et al, 1996; Campbell, 1999; Alalwan, 2018), we expect the differences in purchase intentions across conditions to be impacted by differences in the variables we captured

- We use a latent utility model to estimate differences in expected consumer utility across the experimental conditions

- Before revealing vendor quality: $utility_{Ad} > utility_{Search} > utility_{Random}$
- After revealing vendor quality: $utility_{Search} > utility_{Ad} > utility_{Random}$

	(1)	(2)
Coefficient/DV	PI3	PI4
Log(Price)	-0.22**	-0.30**
	(0.07)	(0.07)
Quality	0.26**	0.20**
	(0.07)	(0.07)
Relevance	1.05**	0.88**
	(0.08)	(0.07)
Familiarity with product type	-0.03	-0.07
	(0.05)	(0.05)
Familiarity with Brand	0.13***	0.06
	(0.03)	(0.03)
Familiarity with Vendor		0.16**
		(0.03)
Use of Privacy Enhancing Technologies		
BBB Rating (base category: B- to A+)		
B- to A+	Base category	
C- to D+		-0.46
		(0.32)
F		-1.20**
		(0.26)
No Rating		-0.12
		(0.21)
N	3555	3555

Notes. Robust standard errors clustered by participant in parenthesis.
All models include controls for product category and participant characteristics.
* $p < 0.05$; ** $p < 0.01$

Table 6. Average welfare differences across conditions and PI Questions (Study 2).

Welfare gains	Value
Ad vs search when the vendor is not known	$3.53
Ad vs random when the vendor is not known	$8.43
Ad vs search when the vendor and quality are shown	-$0.54
Ad vs random when the vendor and quality are shown	$9.77

Note. Differences are per product per participant.

Robustness tests

- Results robust to:

- Other specifications
- Time delay
- Usage of privacy technologies

Limitations

- Only display ads, and only Google searches
- Purchase intentions, not actual purchase behavior
- However, studies have shown that purchase intentions are in fact a good proxy (Morwitz et al., 2007; Pavlou & Fygenson, 2006).
- Our measures of product quality are driven by an impression of the participant based on limited information
- We opted not to use product ratings, since they are a poor measure of objective product quality (Köcher & Köcher, 2018)
- Our results may not extend to social media ads or ads on other platforms (e.g. Amazon), or mobile ads

Findings and implications

- Search results heavily dominated by large vendors - barrier to entry for small sellers
- Both search results and targeted display ads distributions exhibit high concentration towards the top websites. However, targeted display ads come from lesser-known, smaller vendors
- Ads are associated with higher purchase intentions, relevance, and familiarity relative to Search
- But this effect goes away after controlling for prior product searches
- Ads are also associated with higher prices, and lower quality vendors

Thank you

- In a nutshell: (direct) impact of targeted display ads on consumer welfare? Nuanced

The big picture

One study

Current work