

Advertising effectiveness

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The plan

- ▶ Motivation
- ▶ Measuring effectiveness of advertising with observational data
 - ▶ Aggregate data on sales and advertising expenditures
 - ▶ Micro data on consumers seeing/not seeing online advertisement
- ▶ Field experiments in advertising
 - ▶ Advantages
 - ▶ Example

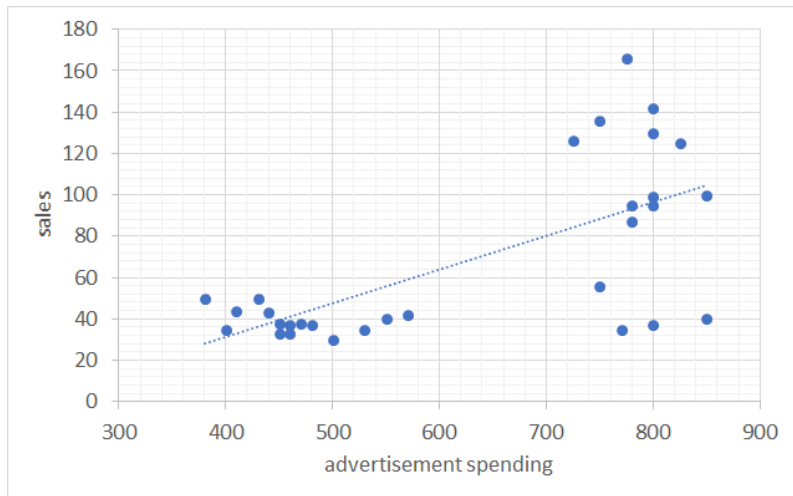
Effectiveness of advertisement

- ▶ “Half the money I spend on advertising is wasted; the trouble is I don't know which half.”
John Wanamaker
(Department store merchant, 1838-1922)
- ▶ Measuring effectiveness of advertising has always been difficult.

What do we know today?

- ▶ This was over 100 years ago.
- ▶ Today, we have computers and statistical software
- ▶ Today, we also have access to tons of data (huge databases of customers in each firm)
- ▶ Can we do something with this data to study the effectiveness of advertisement?

Effectiveness of advertisement based on aggregate data



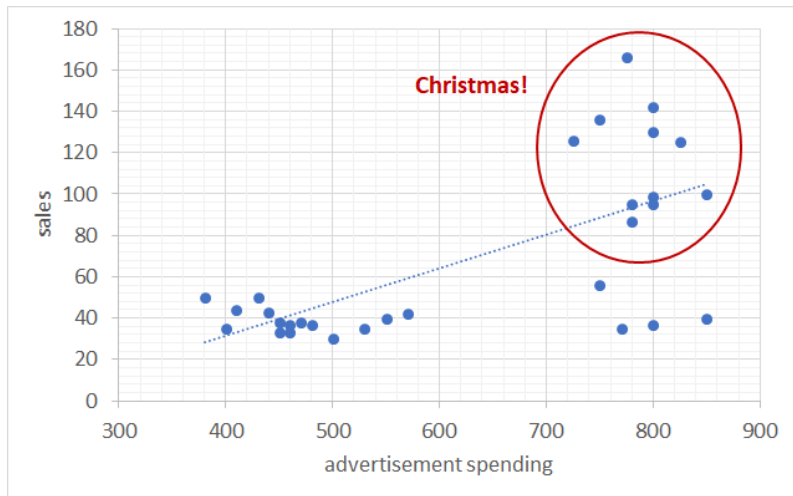
Effectiveness of advertisement based on aggregate data

- ▶ What is your interpretation of the graph? Does advertisement increase sales?

Effectiveness of advertisement based on aggregate data

- ▶ What is your interpretation of the graph? Does advertisement increase sales?
- ▶ Main question: What causes advertising to vary over time?
 - ▶ What if the company does more advertising in the cities where there is less sales?
 - ▶ What if the company does more advertising in the period when they would have more sales anyway?
- ▶ Correlation is not causality.

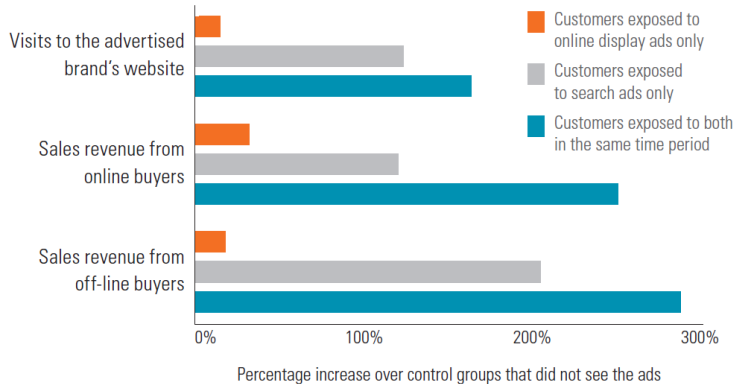
Effectiveness of advertisement based on aggregate data



Effectiveness of advertisement based on micro data

- ▶ Get data on individual customers behavior (online search, websites visited, transactions made, advertisement viewed, in-store sales)
- ▶ Where to get such data?
 - ▶ For example, comSource is a firm that gives people a small reward (payment) if they install a tracking software to their computers - they have data for over 2 million people
 - ▶ Combine it with a survey or with firms' frequent-buyer databases to get data on in-store sales
- ▶ Analyse effectiveness of advertisement:
 - ▶ Compare online and in-store purchases made by those who have and those who have not seen the advertisement.

Effectiveness of advertisement based on micro data: Results



Source: Abraham, M. (2008). The off-line impact of online ads. Harvard Business Review, 86(4), 28.

Effectiveness of advertisement based on micro data

- ▶ Potential problems?

Effectiveness of advertisement based on micro data

- ▶ Potential problems?
- ▶ What about selection?
- ▶ Who are the people who see on online add?
 - ▶ Those who searched for a key word related to this add.
 - ▶ Likely those who considered buying it anyway...
- ▶ Correlation is not causality.

Experiments in advertising

- ▶ A standard RCT procedure.
- ▶ Create a randomly selected treatment group of people who are exposed to an online add and a randomly selected control group of people who are not.
- ▶ These two groups should be on average the same, so the observed difference in sales is caused by advertisement.
- ▶ Possible outcomes:
 - ▶ online searches
 - ▶ online sales
 - ▶ offline sales (if combined with data from firm databases)

Lewis and Reiley (2014)

- ▶ "Online ads and offline sales: Measuring the effects of retail advertising via a controlled experiment on Yahoo!"
- ▶ A randomized experiment with 1.6 million customers
 - ▶ Match the database of a retailer and Yahoo! to get data on both online behavior and offline sales
 - ▶ 80% of costumers assigned to the treatment group - exposed to campaigns from the retailer on Yahoo!
 - ▶ 20% of costumers assigned to the control group - no retailer adds
- ▶ Online and in-store sales data: weekly individual-level data (anonymized)

Lewis and Reiley (2014): Online ads

The screenshot shows the Yahoo! homepage interface from July 22, 2008. At the top, there is a search bar with the text "Search:" and a "Web Search" button. Below the search bar, there are navigation links for "Web", "Images", "Video", "Local", "Shopping", and "more". The main content area is divided into several sections:

- Featured:** A large article titled "Gravity-defying skyscraper" with a photo of a building. The text says: "Designers say making this building was so complex it couldn't have been built a few years ago. → Location" and "Photos: Beijing's odd architecture" and "Find the tallest skyscrapers".
- News:** A section with a "World" tab selected. It lists several news items:
 - Obama vows to work for Mideast breakthrough | Reactions
 - Speculation swirls about McCain VP / announcement soon?
 - Iraq faces a tough sell: Luring tourists to Baghdad
 - Traffic deaths across U.S. plummet as gas prices rise
 - Zimbabwe prints \$100 billion note to deal with hyperinflation
 - How a hefty Florida town has kept out condos and chain stores
 - Exploding star in the Milky Way almost went unnoticed
- Today Only:** A promotional banner for "INSPIRON™ I525 LAPTOP ON SALE" with a "BUY NOW" button and a "Dell" logo.
- Small Business:** A section with links for "Get a Web Site", "Domain Names", "Sell Online", and "Search Ads".
- Marketplace:** A section with a "Marketplace" link and a quote: "Why online collage is rocking".

Lewis, R. A., & Reiley, D. H. (2014). Online ads and offline sales: measuring the effect of retail advertising via a controlled experiment on Yahoo!. *Quantitative Marketing and Economics*, 12(3), 235-266.

Lewis and Reiley (2014): Randomization

	Control	Treatment
% Female	59.50 %	59.70 %
% Retailer ad views > 0	0.00 %	63.70 %
% Yahoo page views > 0	76.40 %	76.40 %
Mean Y! page views per person	358	363
Mean ad views per person	0	25
Mean ad clicks per person	0	0.056
% Ad Impressions Clicked (CTR)	-	0.28 %
% Viewers clicking at least once	-	7.20 %

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Lewis and Reiley (2014): Results

Table 4 Mean sales by treatment group and exposure

	Number of observations	Mean sales before campaign (2 weeks)	Mean sales during campaign (2 weeks)	Mean sales difference (During - Before)
Control:	299,426	R\$ 1.945 (0.037)	R\$ 1.842 (0.033)	-R\$ 0.103 (0.048)
Treatment:	1,277,830	1.934 (0.018)	1.894 (0.017)	-0.039 (0.024)
Exposed:	814,052	1.813 (0.021)	1.811 (0.021)	-0.002 (0.029)
Not Exposed:	463,778	2.146 (0.034)	2.042 (0.031)	-0.104 (0.042)

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Lewis and Reiley (2014): Discussion

- ▶ Control group sales fall, treated (exposed) do not change - positive effect of advertising.
- ▶ Estimated sales impact for the retailer: $R\$83,000 \pm 70,000$ (95% confidence interval) compared to costs of $R\$25,000$
- ▶ What if they did not do an RCT, but only compared those exposed and those not exposed during campaign?
 - ▶ They would conclude that ads decreased sales!
 - ▶ Looking at pre-campaign data, we see that these two groups are very different.

Lewis and Reiley (2014): Long-term effects?

- ▶ Positive effect during campaign might be followed by long-term:
 - ▶ negative effect on sales (intertemporal substitution)
 - ▶ zero effect on sales
 - ▶ positive effect on sales (persistence)

Lewis and Reiley (2014): Long-term effects

	Treatment effect*	Robust S.E.
The Campaign		
Week 1 During	R\$ 0.047	(0.024)
Week 2 During	R\$ 0.053	(0.024)
Week 1 Following	R\$ 0.061	(0.024)
Follow-up Campaign		
3 Weeks Before	R\$ 0.011	(0.028)
2 Weeks Before	R\$ 0.030	(0.029)
1 Week Before	R\$ 0.033	(0.024)
Week 1 During	R\$ 0.052	(0.029)
Week 2 (3 Days)	R\$ 0.012	(0.023)
Week 1 Following	R\$ 0.004	(0.028)
Average	R\$ 0.035	(0.016)

Lewis, R. A., & Reiley, D. H. (2014). Online ads and offline sales: measuring the effect of retail advertising via a controlled experiment on Yahoo!. *Quantitative Marketing and Economics*, 12(3), 235-266.

Lewis and Reiley (2014): Online/offline sales

Table 7 Offline/online and viewer/clicker ad effect decomposition

	Total sales	Offline sales	Online sales
Ads viewed (β , Eq. 6)	R\$ 0.166	R\$ 0.155	R\$ 0.011
[63.7 % of Treatment group]	(0.052)	(0.049)	(0.016)
Ads viewed, not clicked (β_0 , Eq. 10)	R\$ 0.139	R\$ 0.150	-R\$ 0.010
[92.8 % of Viewers]	(0.053)	(0.050)	(0.016)
Ads clicked (β_1 , Eq. 10)	R\$ 0.508	R\$ 0.215	R\$ 0.292
[7.2 % of Viewers]	(0.164)	(0.157)	(0.044)

DID estimates; bold denotes statistical significance at the $\alpha = 0.05$ level

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Conclusion

- ▶ Problems with measuring the effectiveness of ads:
 - ▶ Reverse causality (advertising more where sales are lower/higher)
 - ▶ Omitted variables (Christmas)
 - ▶ Sample selection (people exposed to ads are not the same as those who are not exposed)
- ▶ In order to measure the impact of advertisement on sales, we need to introduce a random assignment to advertisement exposure - RCT in online advertising
- ▶ To measure ad effectiveness, we need large samples, because the effects are small (confidence intervals)



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