Advertising effectiveness

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Applied Microeconomics, VŠE
Summer Semester 2017/2018

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

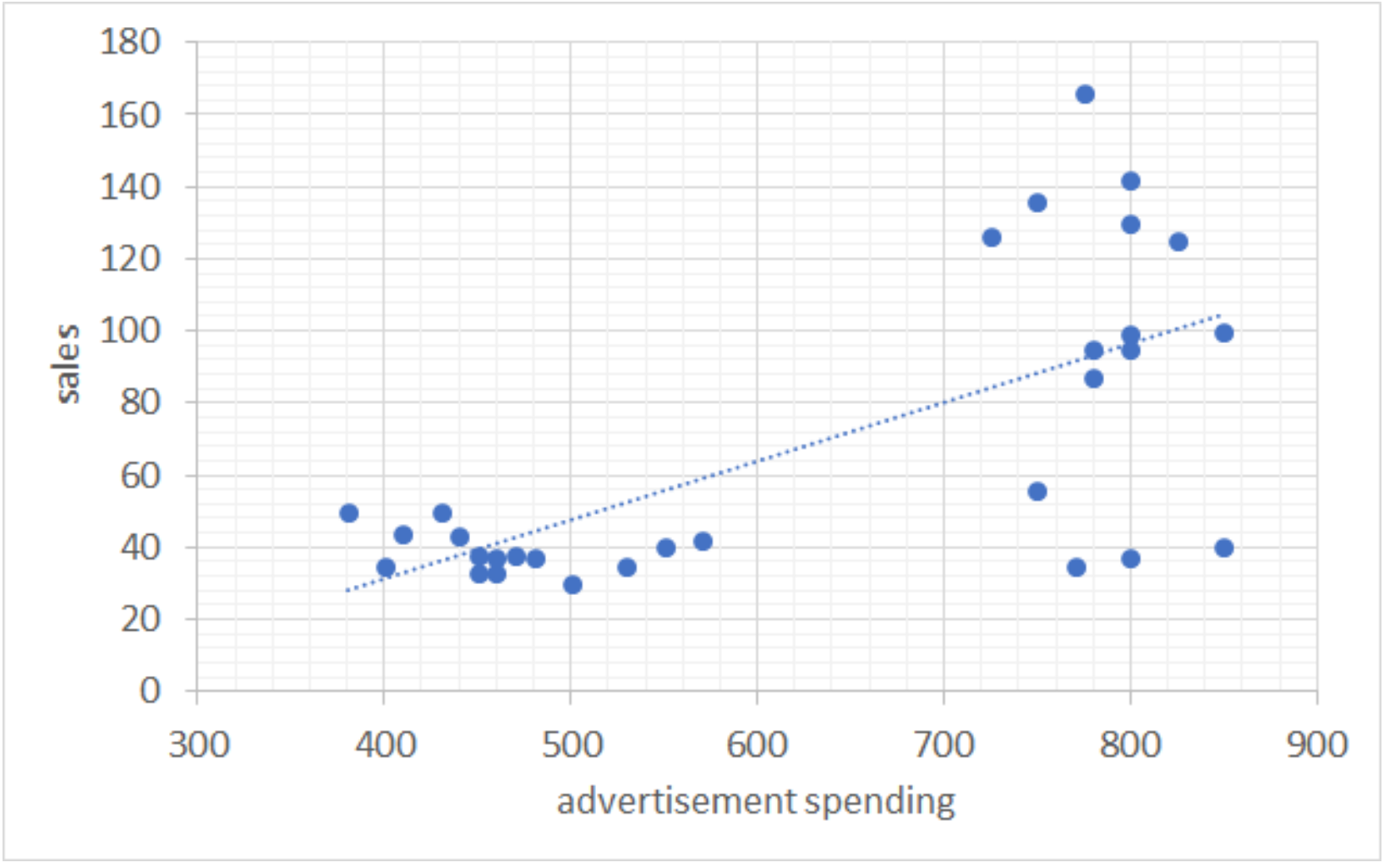
Effectiveness of advertisement

- "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



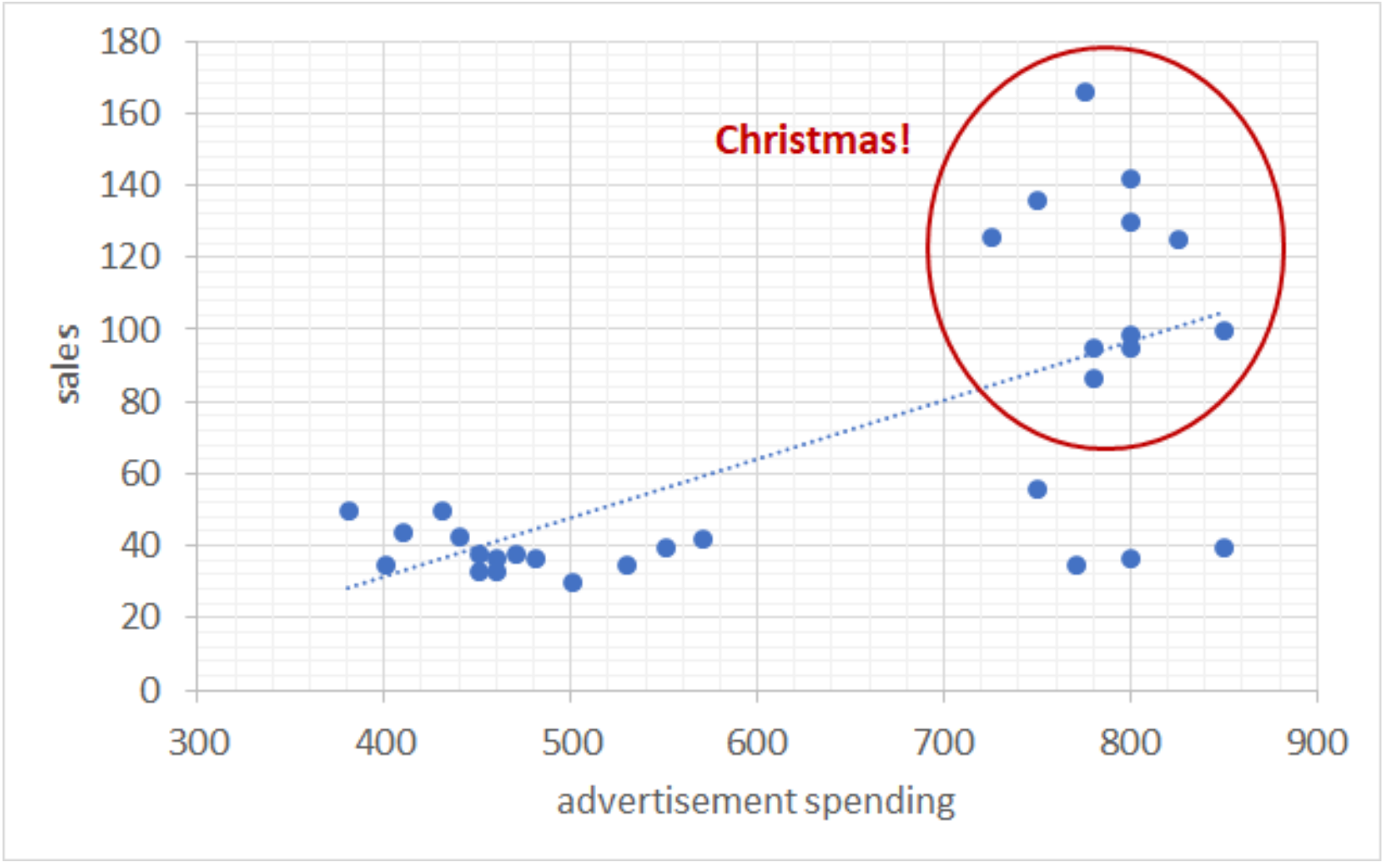
Effectiveness of advertisement based on aggregate data

- 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.

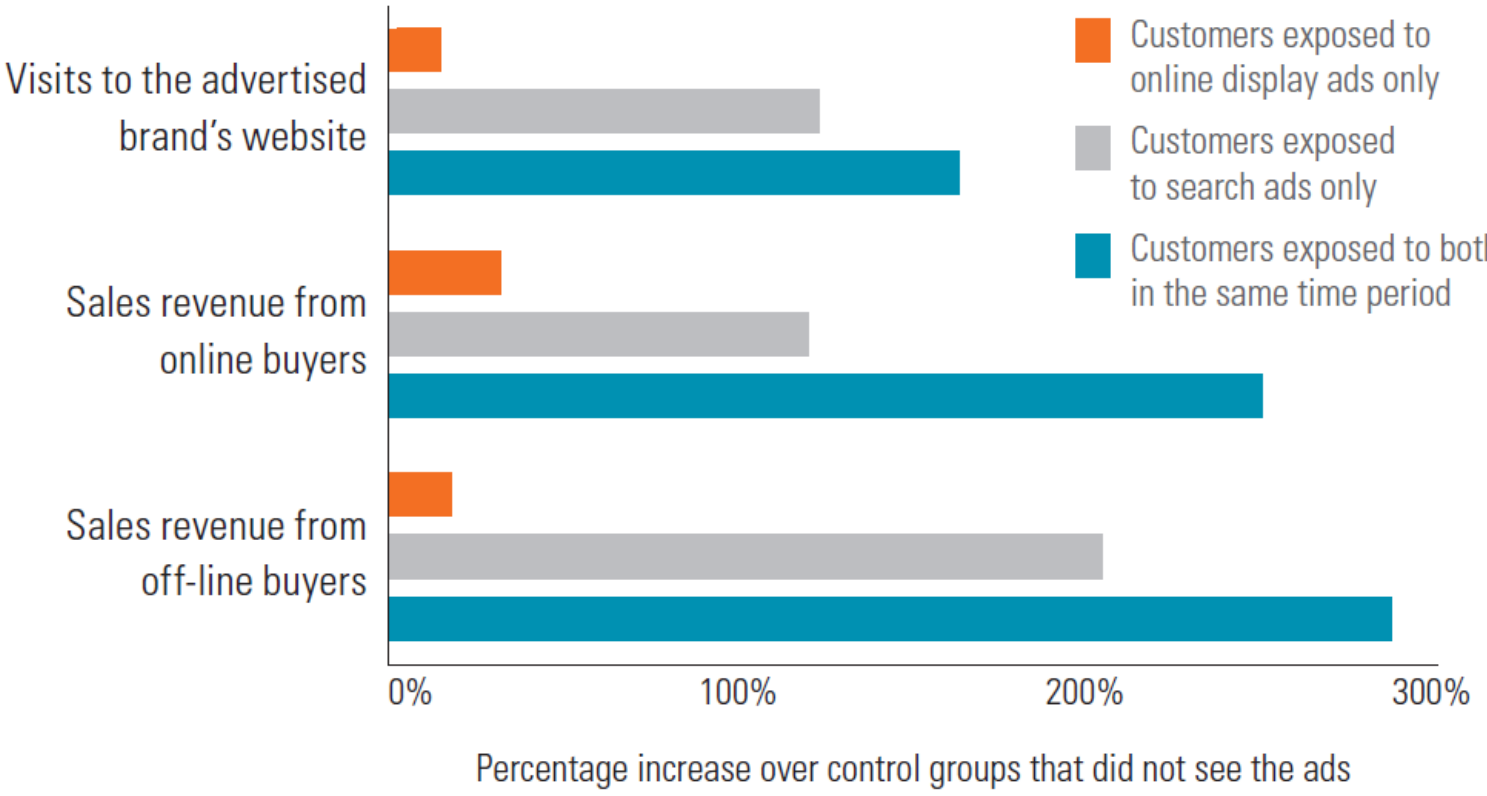
Effectiveness of advertisement based on aggregate data



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

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 %

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): 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	R$ 1.842	-R$ 0.103
		(0.037)	(0.033)	(0.048)
Treatment:	1,277,830	1.934	1.894	-0.039
		(0.018)	(0.017)	(0.024)
Exposed:	814,052	1.813	1.811	-0.002
		(0.021)	(0.021)	(0.029)
Not Exposed:	463,778	2.146	2.042	-0.104
		(0.034)	(0.031)	(0.042)

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): 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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Národohospodářská fakulta VŠE v Praze