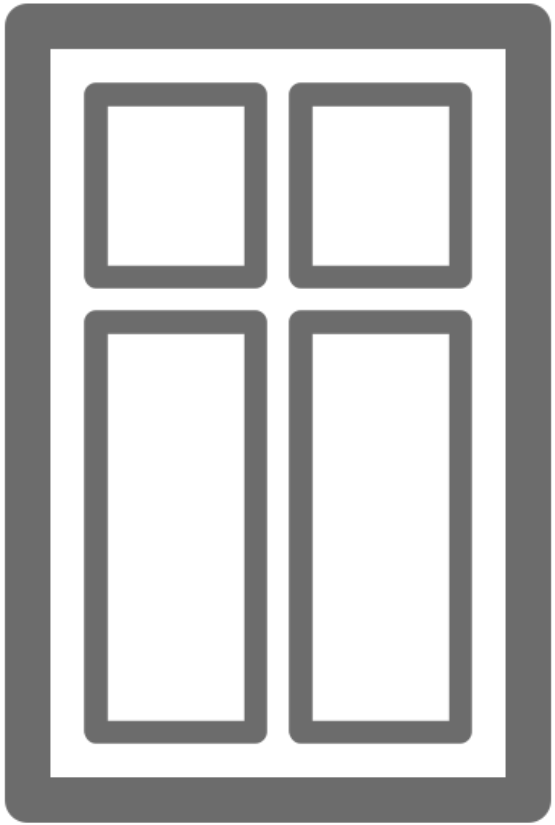

GKC: Media Campaign Analysis

Brandon Curtis, Lingjie Qiao, Tina Guo,
Akshita Singh, Abbey Chaver

Agenda

- Methodology
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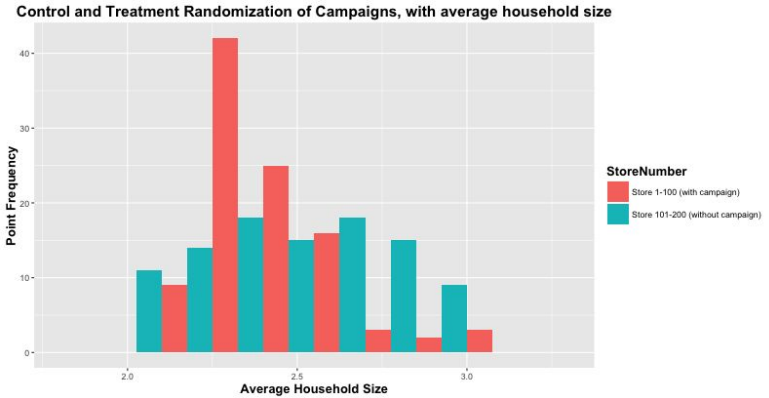
Comparing Two Populations

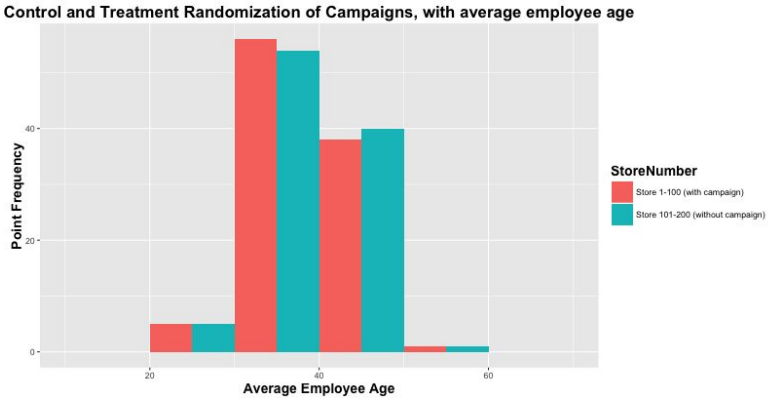
- If our treatment and control group have different characteristics, and those characteristics affect the response, our data cannot provide valid conclusions.
- Approach: evaluate differences in characteristics in the populations through t-tests on means and charts.
- Evaluate correlations between characteristics and sales during analysis.

Quantitative Conclusion: No significant differences between populations

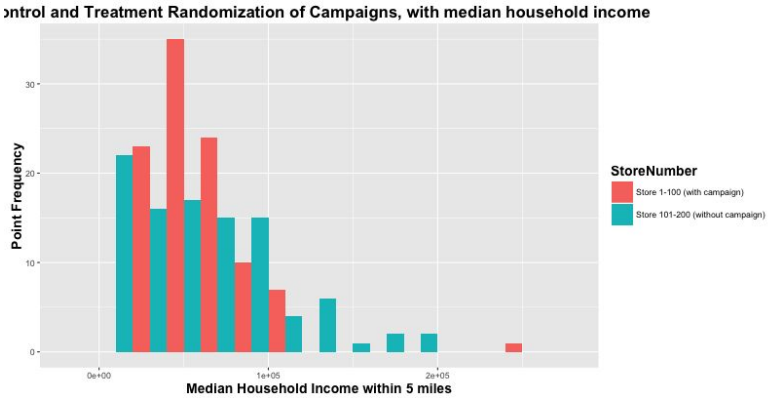
Control vs. Treatment Group



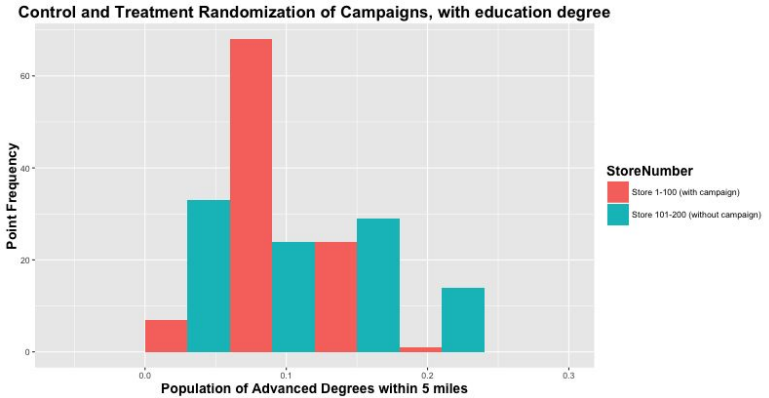
Average Household Size



Average Employee Age

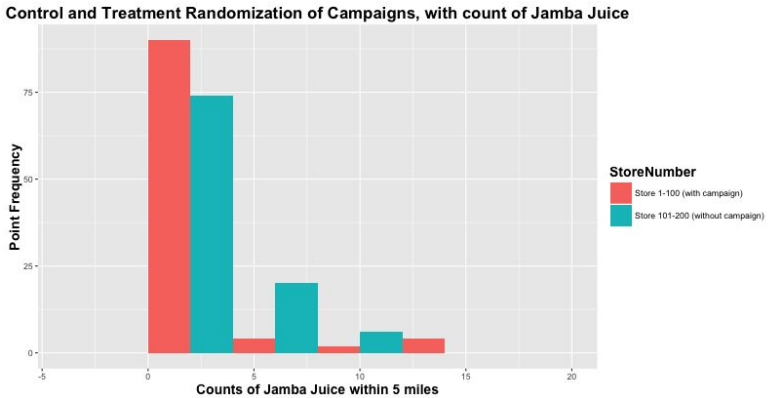


Median Household Income

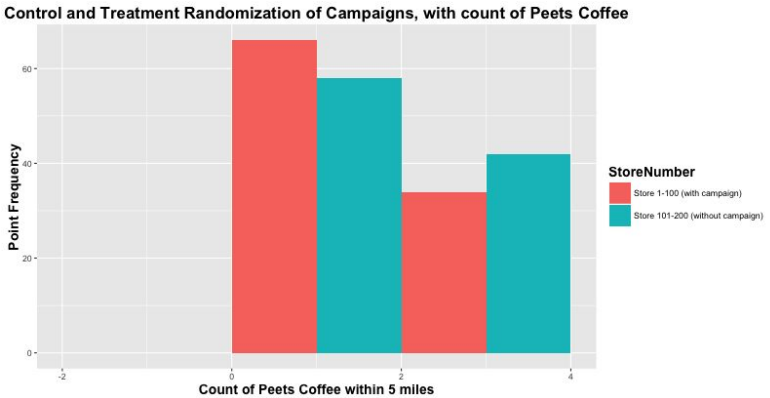


Education Level

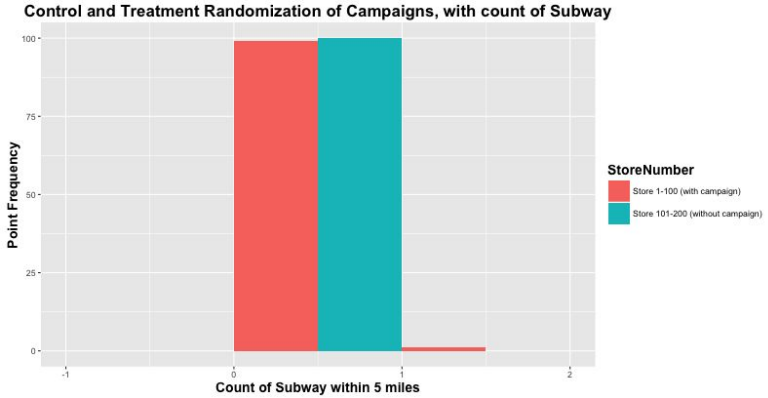
Control vs. Treatment Group



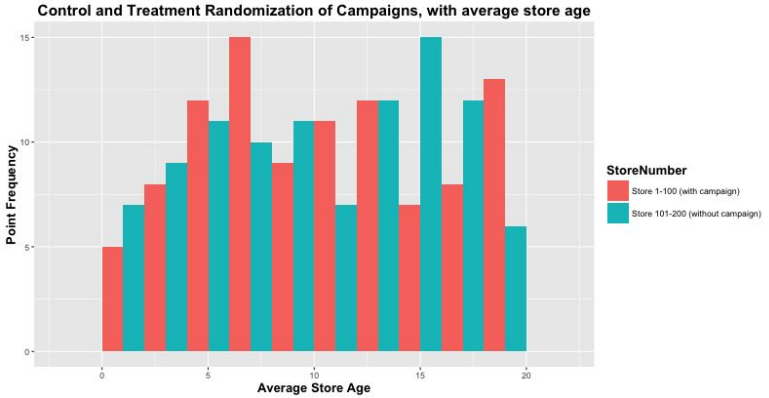
Count of Jamba Juice within 5 miles



Count of Peet's Coffee within 5 miles



Count of Subway within 5 miles



Average Store Age

Assumptions

- No difference in population characteristics
- No secondary effects of campaign on the control stores

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Approach: Primary Tools

- Graphs and Plots: Identifying trends
- Hypothesis testing: Defining queries
- T-test: Identifying significant results
- Linear Regression: Identifying correlations

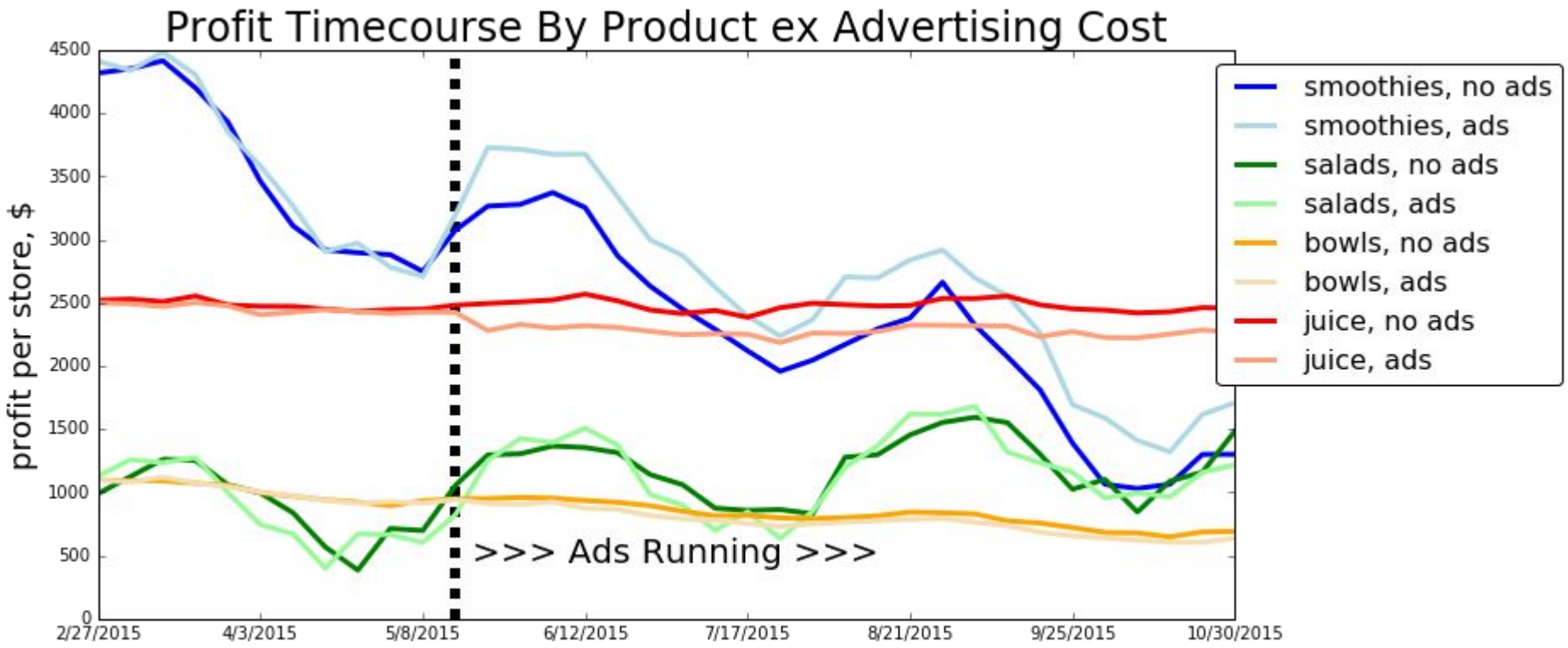
Hypothesis Testing

Null Hypotheses:

- Campaigns have no effect on sales
- Campaigns A, B, and C have the same effect on sales
- Characteristics are not a factor in campaign effectiveness
- Advertising effects only Smoothie sales

A low p-value indicates a significant result.

Do campaigns have any effect?



Do campaigns have any effect?

Approach 1: Compare stores 1-100 before and after campaigns

- Result: Definite difference, but difference consistent across stores with and without ads.
- Issue: Difference due to time, not due to campaigns.

Approach 2: Compare sales between stores with and without campaign

- Result: Campaign outperforms No Campaign
- Issue: Would be better if it normalized over individual store performance

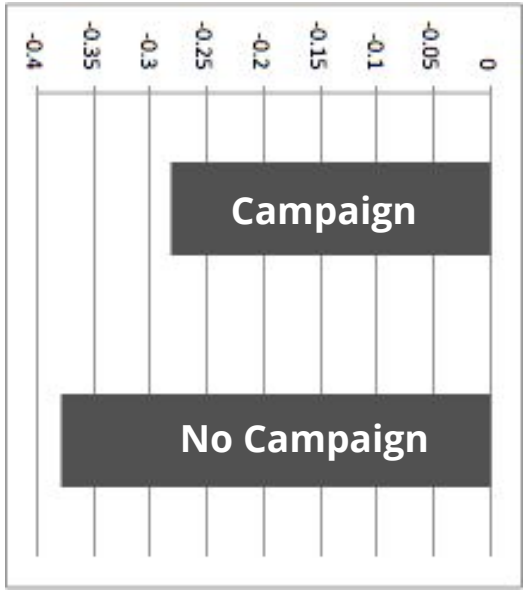
Do campaigns have any effect?

Final Approach: Compare mean percent difference between stores with and without campaign.

P-value = 2.2e-16

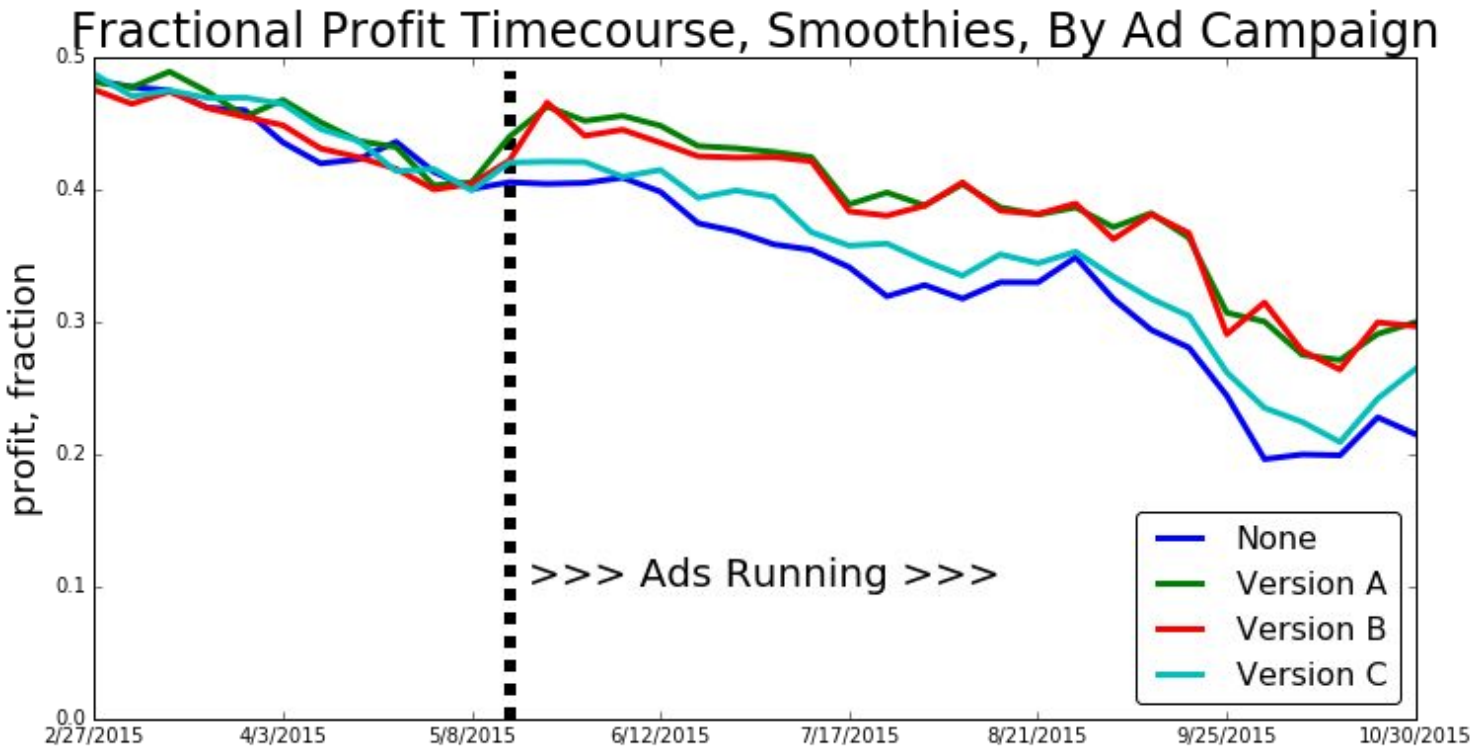
Note that sales data is generally decreasing over time, so values for percent difference are usually negative.

Mean Percent Difference



Conclusion: Campaigns have a positive effect on smoothie sales.

Is there a difference between campaigns?

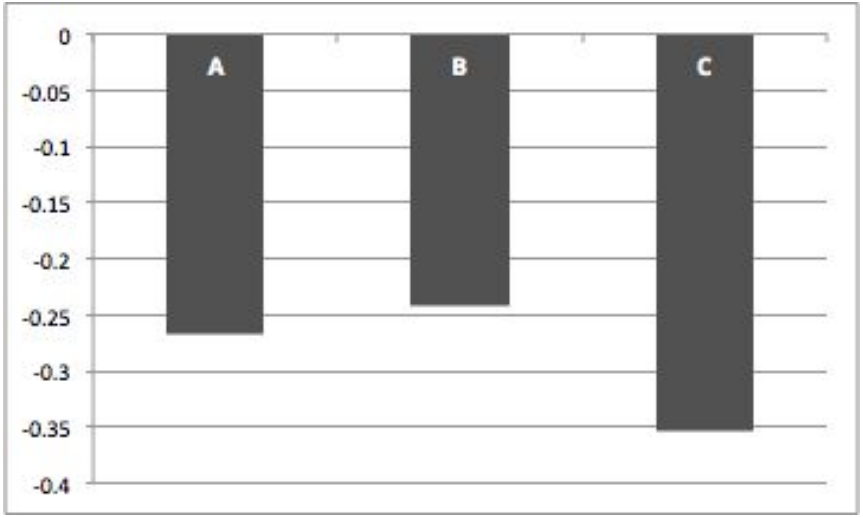


Is there a difference between campaigns?

Test statistic: Percent Difference in Smoothie Sales

ANOVA p-value: 4.599e-11

		P-value
A	B	0.02668
B	C	1.736e-08
A	C	4.257e-06



Conclusion: C is least effective, and B is slightly more effective than A.

Is there a correlation between a characteristic and impact of a campaign?

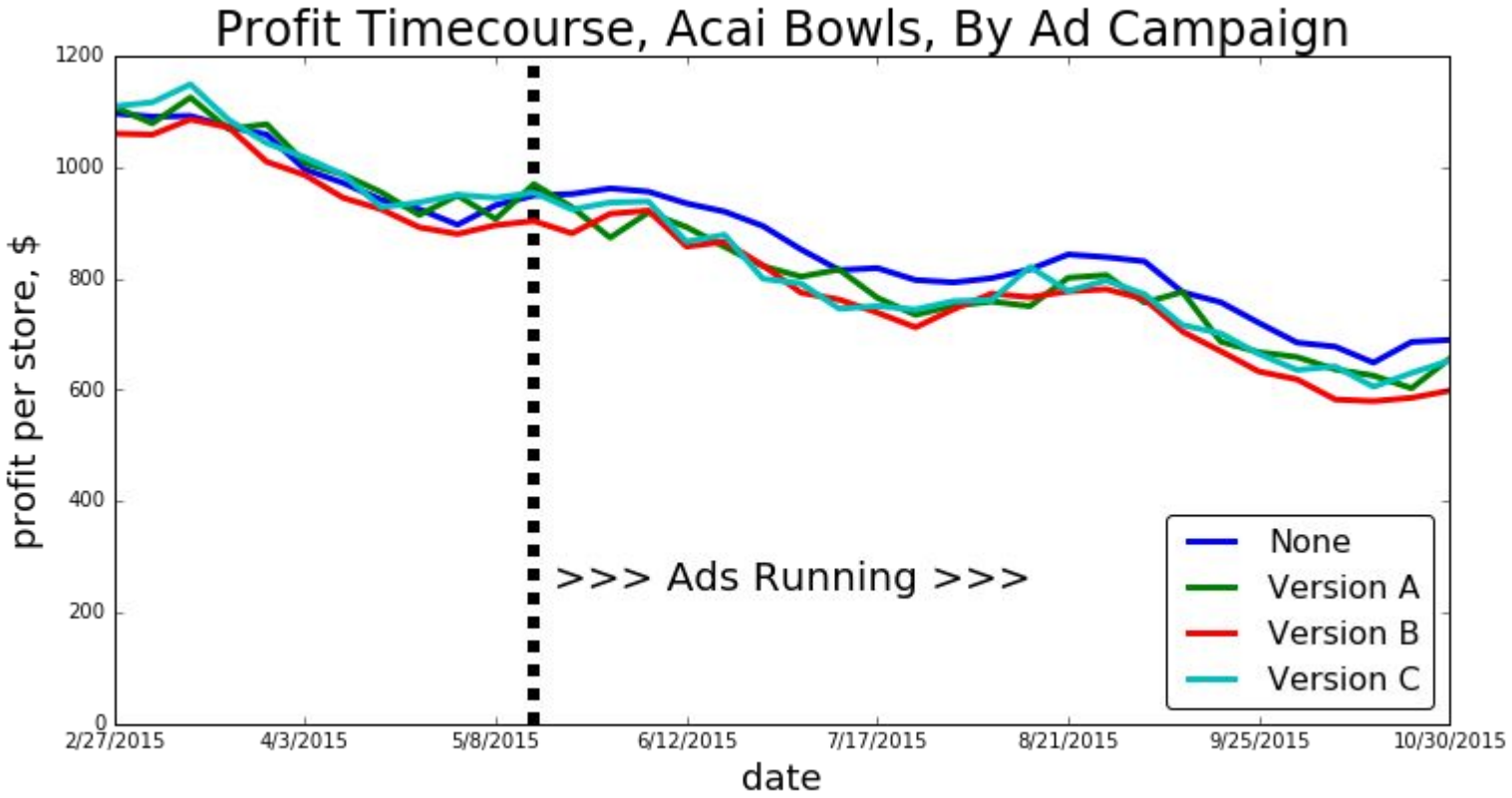
- Split the sales amount into two group: **Before** and **After** advertising
- Using Linear Regression, we evaluated whether there is a relationship between campaign and store characteristics.
- Analysis of correlation

Is there a correlation between a characteristic and impact of a campaign?

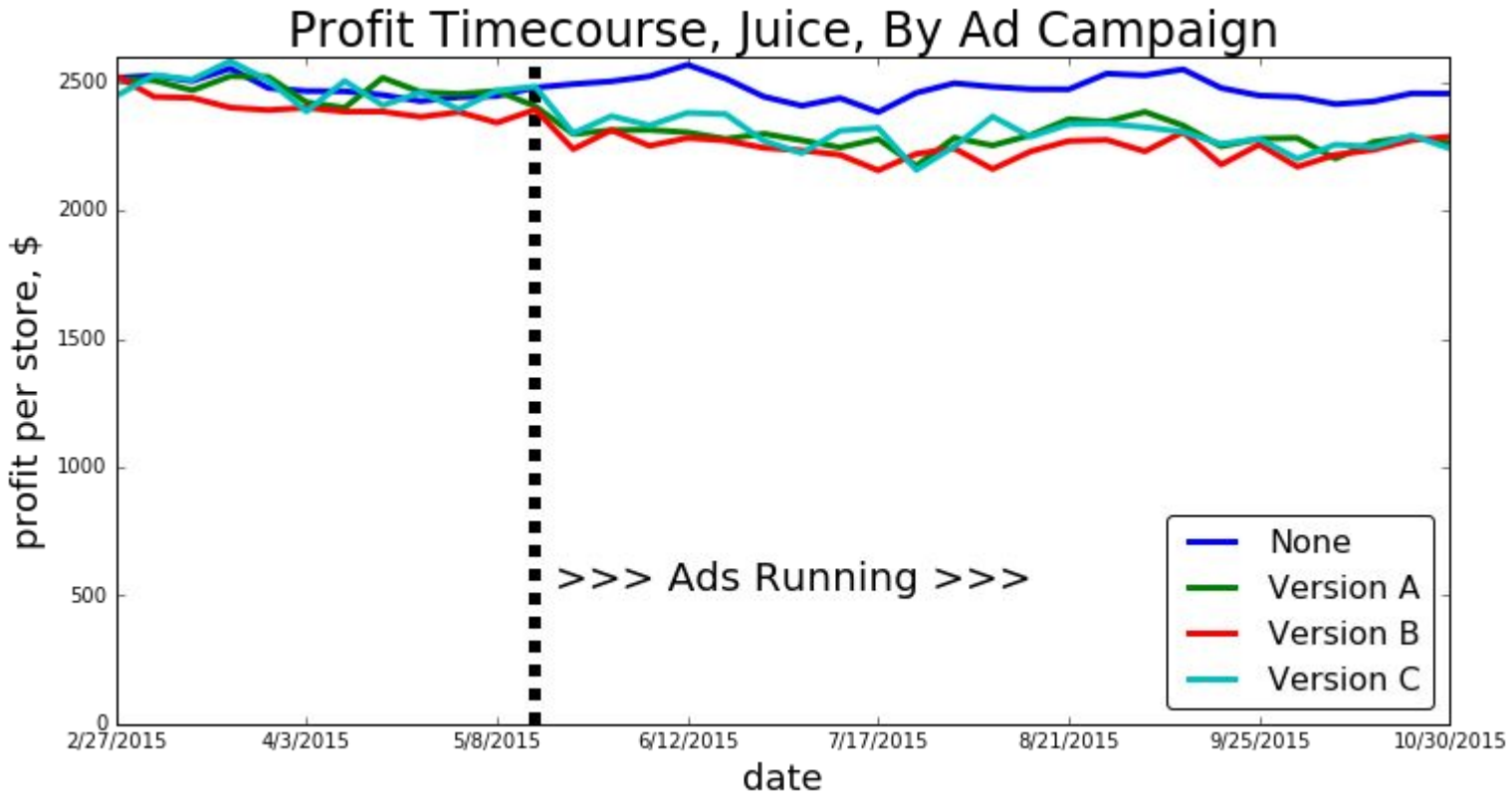
- Correlations are very close to 0
- Very few relationships were statistically significant: The only significant result was that Campaign C was correlated with negative performance in highly educated neighborhoods.

Conclusion: Store characteristics are generally not a good predictor of campaign effectiveness.

Was there an effect on sales of other items?

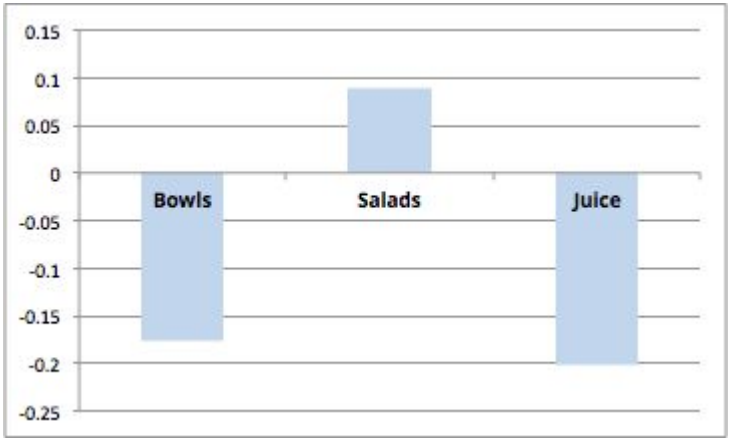


Was there an effect on sales of other items?

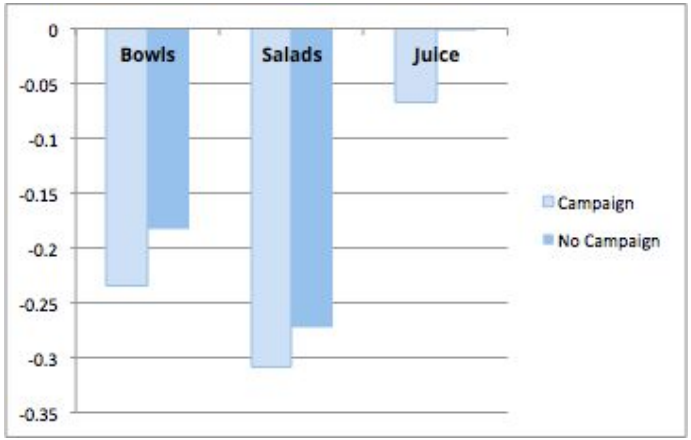


Was there an effect on sales of other items?

Correlating Consumption:
Slope of regression against Smoothie



Campaign Effect on Other Items:
T-Test of Percent Difference



All p-values significant.

Conclusion: Negative effect - Smoothie sales correlate negatively with bowls and juice. Advertising decreased consumption for other items.

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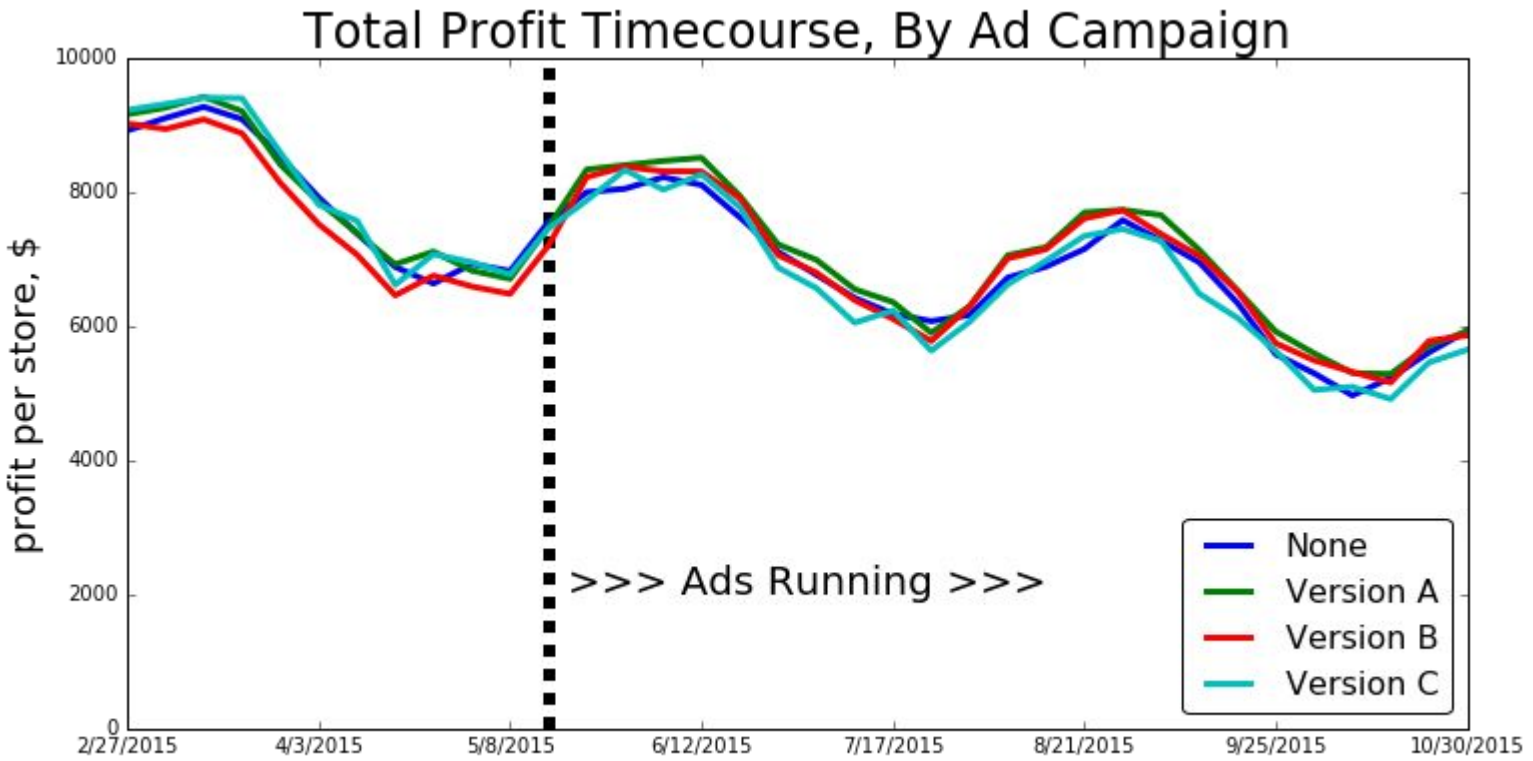
Ultimate goal: Increasing Profit



Does advertising increase profits?

Running a t-test on mean percent difference of total sales:

P-value: 0.002819

The difference is significant, but small.

Conclusion: Advertising does not have a significant effect on sales. Therefore, the expense of $3000 per ad is probably not justified.

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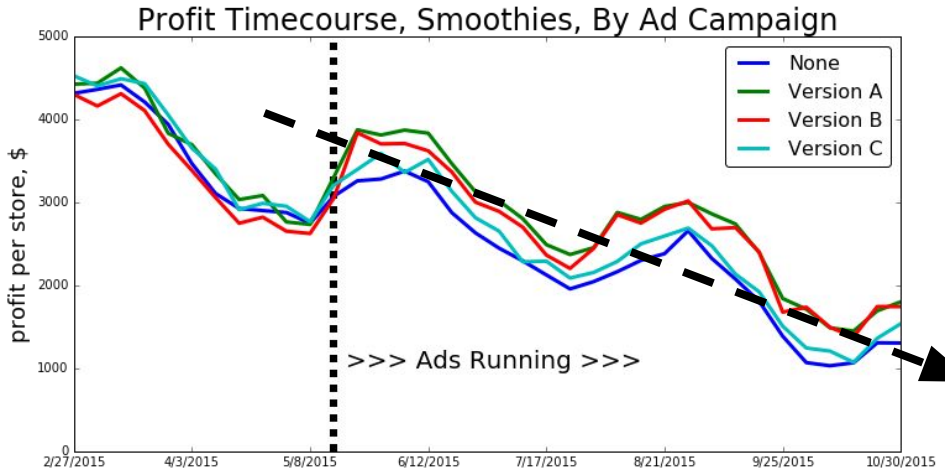
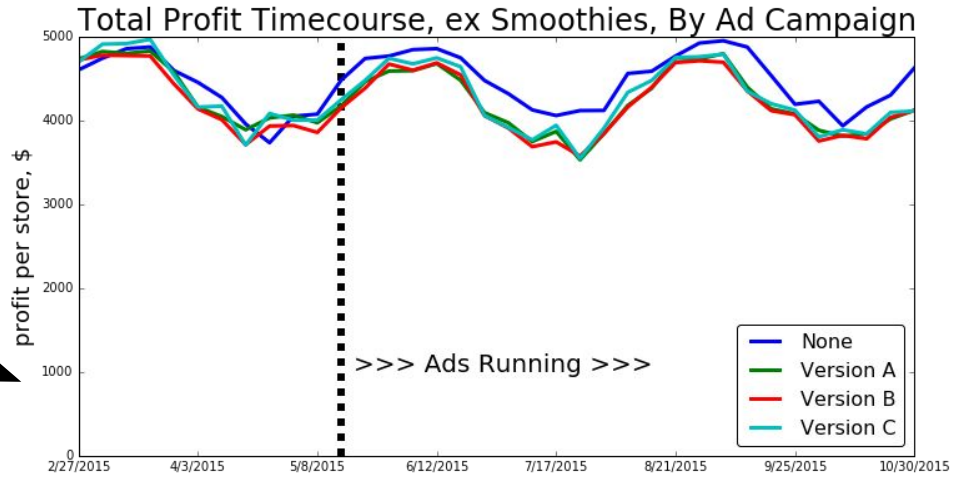
We can assert with confidence:

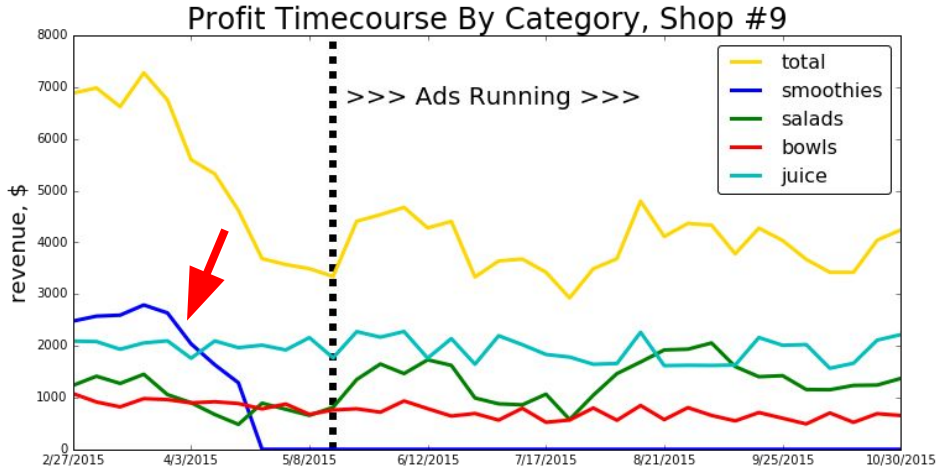
- Campaigns have an effect on Smoothie sales
- B closely outperforms A, and both far outperform C
- Characteristics do not impact sales
- Campaigns have a negative impact on sales of other items
- Campaigns have a small impact on overall profit

Therefore, we recommend discontinuing the smoothie advertising campaign, as the benefits do not outweigh the costs.

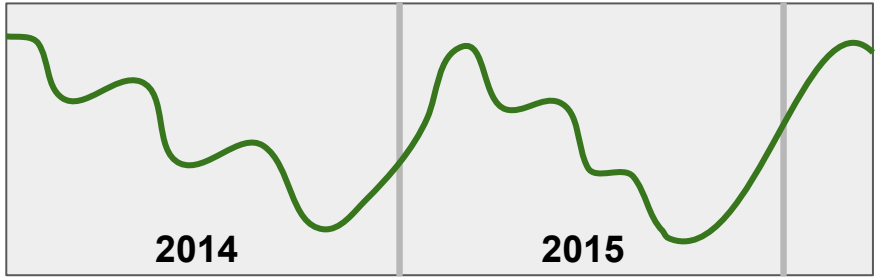
One Store's Solution: Embrace Growing Markets



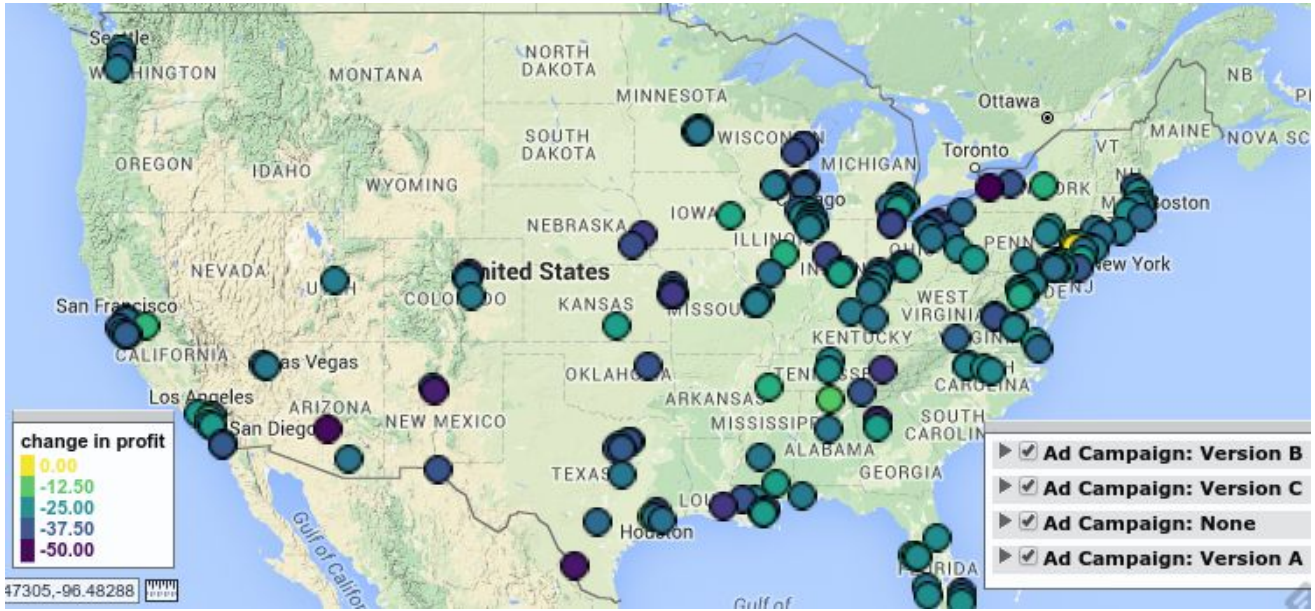




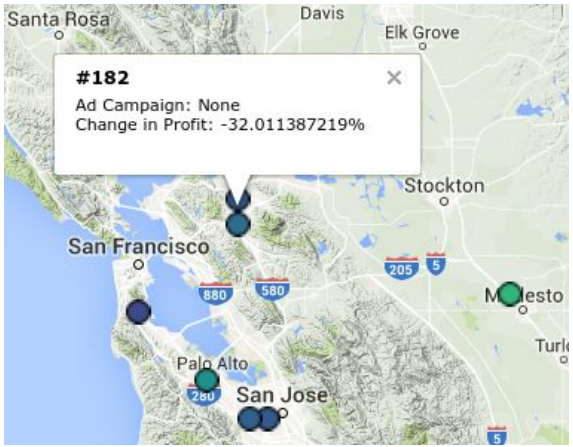
limited data; potentially an annual trend?



Business analytics enable informed response to trends



http://www.brandoncurtis.com/data/apt.html



Questions?

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Quantification of Population Difference: T-test

	Mean of Control Group	Mean of Treatment Group	P-Value
Average Household Size	2.451	2.474	0.492
Average Employee Age	38.128	38.248	0.858
Store Age	10.352	10.264	0.910
Population with Advanced Degree	0.099	0.101	0.666
Median Household Income	60361.54	60046.65	0.953
Count of Peet's Coffee Nearby	0.98	1.17	0.104
Count of Jamba Juice Nearby	1.13	2.01	0.03
Count of Subway Nearby	0.01	0.00	0.320

Correlation between characteristics and sales amount

Correlation	House Hold size	Store Age	Empo Age	Population Degree	Income	Peet's	Subway	Jamba
Smoothies Before	-0.067	-0.074	0.11	-0.041	0.038	-0.0032	-0.091	-0.030
Smoothies After	-0.098	-0.048	0.11	0.0076	0.00067	0.0023	-0.010	0.0036
Salads Before	-0.081	-0.063	0.068	-0.17	0.30	0.057	-0.11	0.094
Salads After	-0.12	-0.062	0.063	-0.17	0.057	0.016	-0.11	0.072
Acai Bowls Before	-0.13	-0.089	-0.12	-0.073	-0.033	0.077	-0.065	-0.083
Acai Bowl After	-0.032	-0.056	-0.12	0.061	-0.050	0.11	-0.061	-0.029
Juice Before	-0.052	-0.080	0.054	0.13	-0.033	0.14	0.046	0.067
Juice After	-0.044	-0.054	0.038	0.090	-0.063	0.094	-0.026	0.097

Was there an effect on sales of other items?

Correlating Consumption: Item vs. Smoothie

Item	Slope	P-value
Bowls	-0.177	3.91E-07
Salads	0.089	0.00633
Juice	-0.201	2.66E-08

Campaign Effect on Other Items: T-Test of Percent Difference

Item	Campaign	No Campaign	P-value
Bowls	-0.2339	-0.1820	2.20E-16
Salads	-0.3087	-0.2716	8.15E-13
Juice	-0.0664	-0.0014	2.20E-16

Conclusion: Smoothie sales correlate negatively with bowls and juice, cannibalizing profits. Advertising decreased consumption for other items.

Technical Acknowledgments

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- the GNU R Project for Statistical Computing
- the SageMath Open Mathematics Project
- UC Berkeley's Project Jupyter