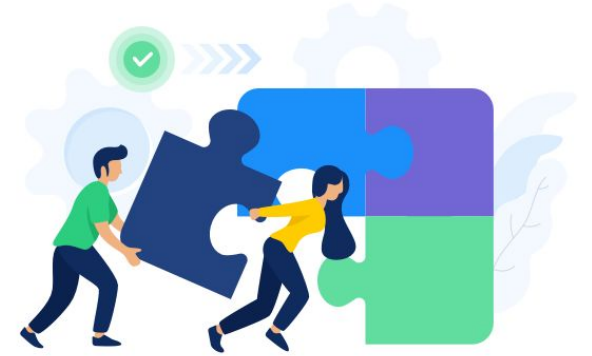**Shuyan Kang**
Main Coder & Slides

Jose Navarro
Communication and Initial Insights

Fangjun Ren
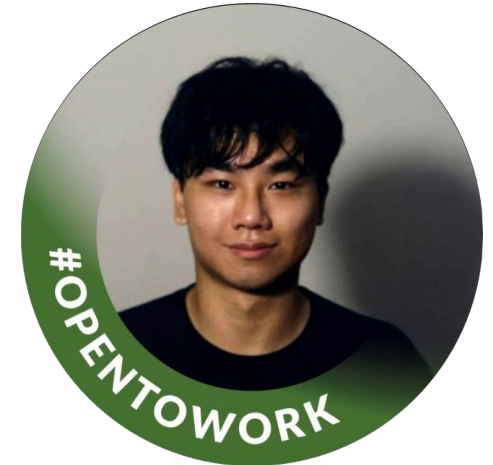Code Review & Slides

Team Members

Lanyue Zhang
Presentation Review

Wenxuan Du
Support
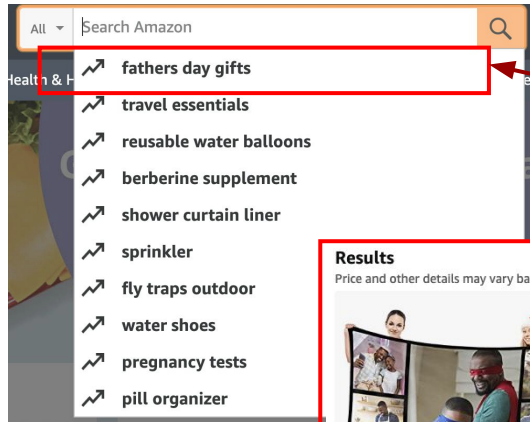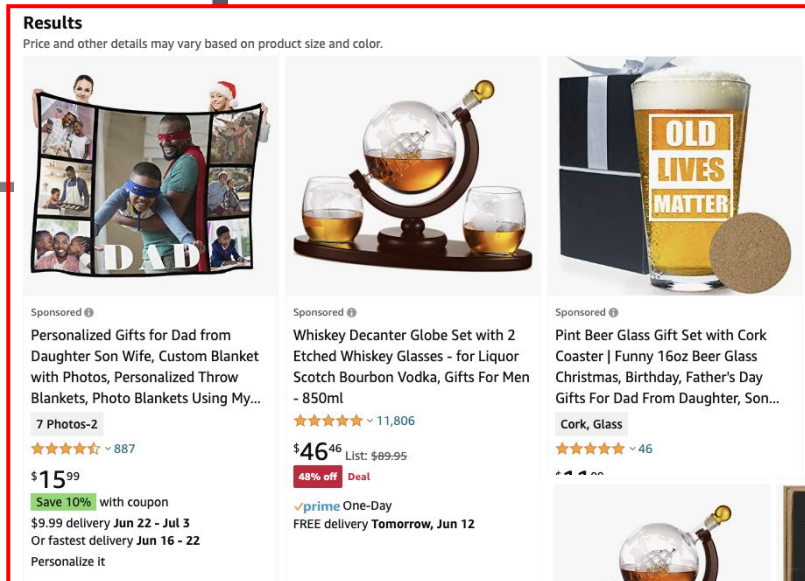
Juntao Li
Support

01

Overview

Keywords: Amazon, Products, Advertisement

Objective: What is the advertisement effect on units sold?

Search Keywords

On Page 1

Top ranking products that customers see

On Page 5

- Bid on keywords to have their products appear on the first page

4

UCLA Economics — Master of Quantitative Economics

Data Source: Daily Sales Performance by ASIN

asin	date	total_rev	units_total	attr_rev	attr_units	ads
B0000225HZ	2022-03-26	0.000	0	0.000	0.000	0
B0000225HZ	2022-03-27	0.000	0	0.000	0.000	0
B0000225HZ	2022-03-28	0.000	0	0.000	0.000	0
B0000225HZ	2022-03-29	113.980	2	0.000	0.000	1
B0000225HZ	2022-03-30	341.940	6	15.730	1.000	1
B0000225HZ	2022-03-31	569.900	10	56.990	1.000	1

- **Date Range:** 1/2/2022 – 1/7/2023
- Limited to **US** products only

Tools & Home Improvement › Power & Hand Tools › Power Tool Parts & Accessories › Battery Packs & Chargers › Battery Packs

Paslode, 6V Ni-Cd Rechargeable Battery, 404717, For all Paslode Cordless Tools
Visit the Paslode Store
4.6 ★★★★☆   796 ratings
$75.99
FREE Returns
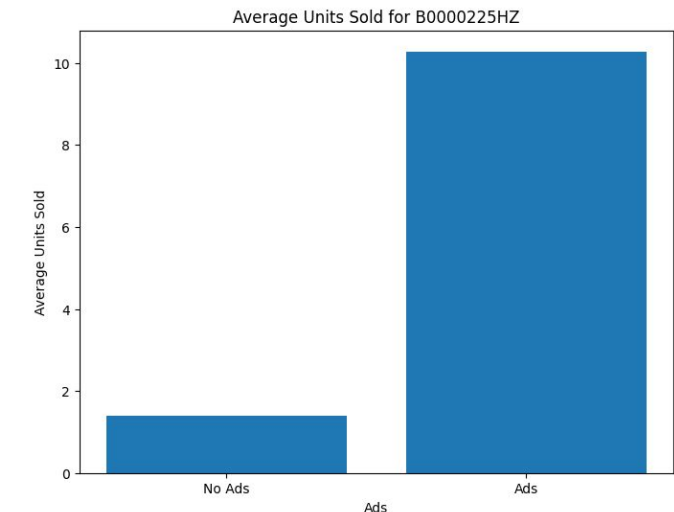Includes $4.66 Amazon discount. Details
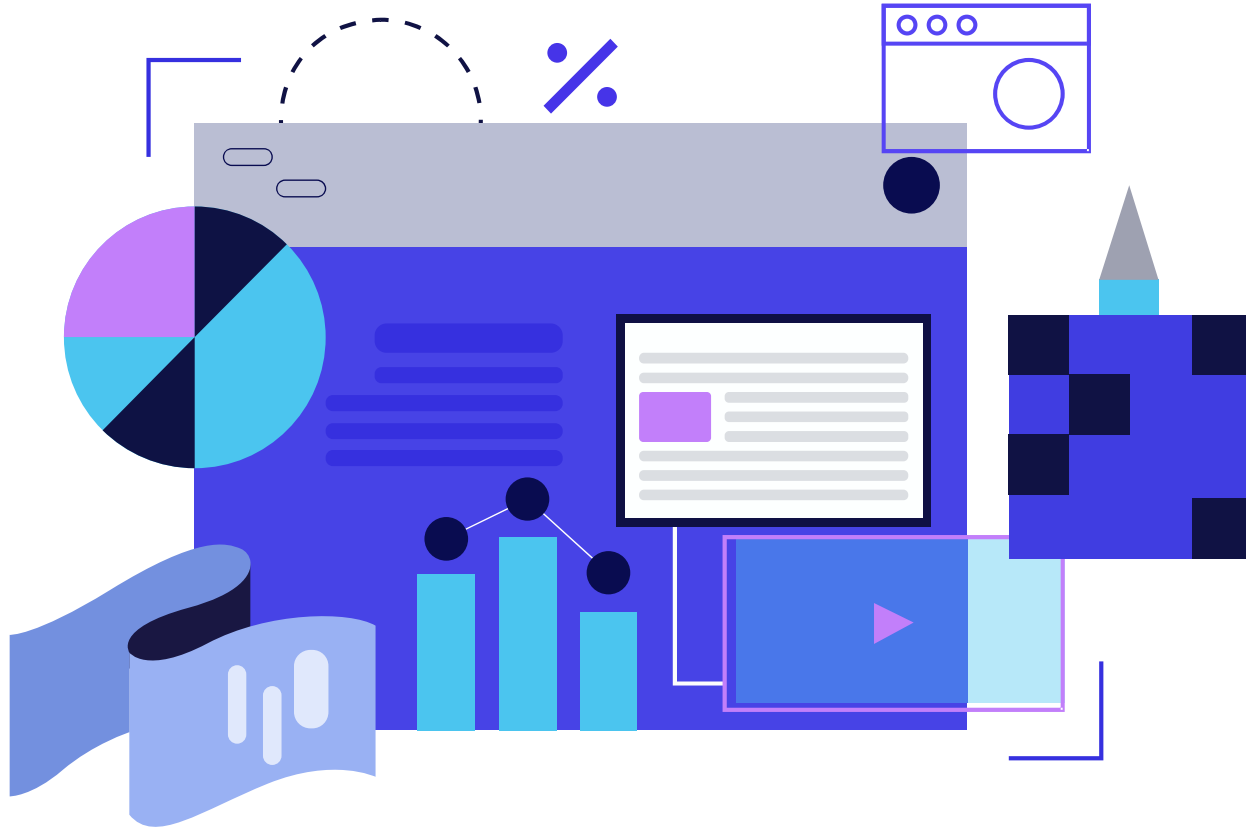**Get a $150 Gift Card:** Pay $0.00 $75.99 upon approval for Prime Visa. No annual fee.
May be available at a lower price from other sellers, potentially without free Prime shipping.

Units Sold for B0000225HZ

Average Units Sold for B0000225HZ
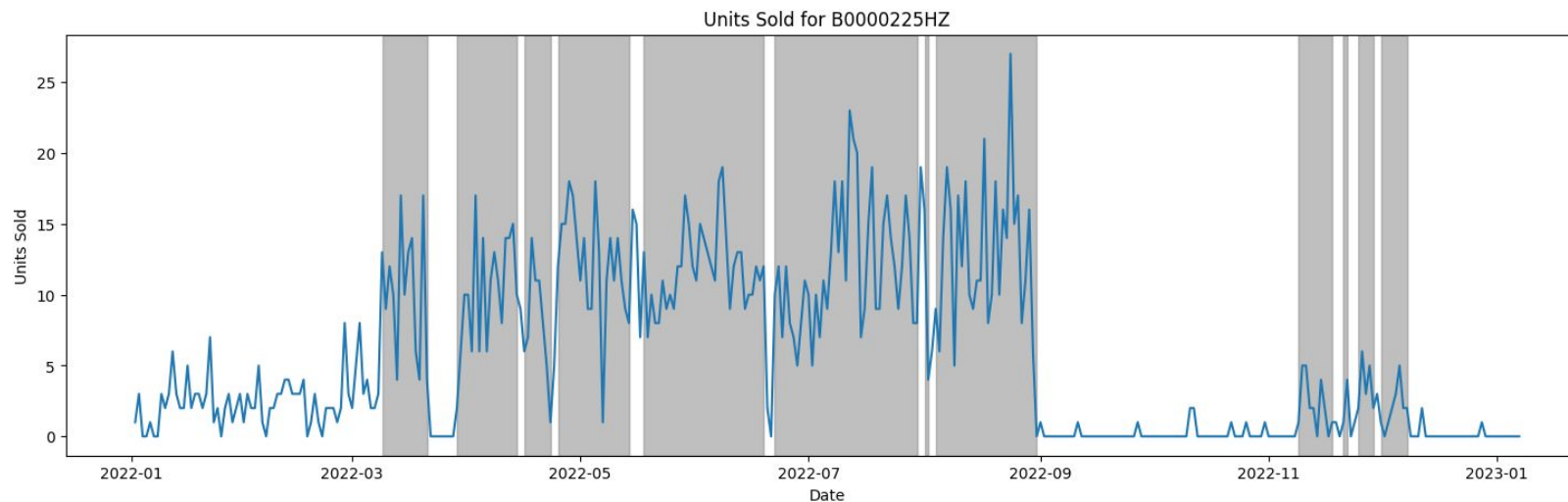
Note: The shaded interval means the advertising period

02

Model Overview

Keywords: DID Models, RDD Method

Difference-In-Differences Model: A basic model to estimate ads effect

Difference-In-Differences Estimation

Intervention Effects

Constant difference in outcome

Pre-treatment   Post-treatment

	R-squared	0.709
treat	-4.091e+09	0.894
after	0.4142	0.009**
treat * after	19.4662	0.000 ***
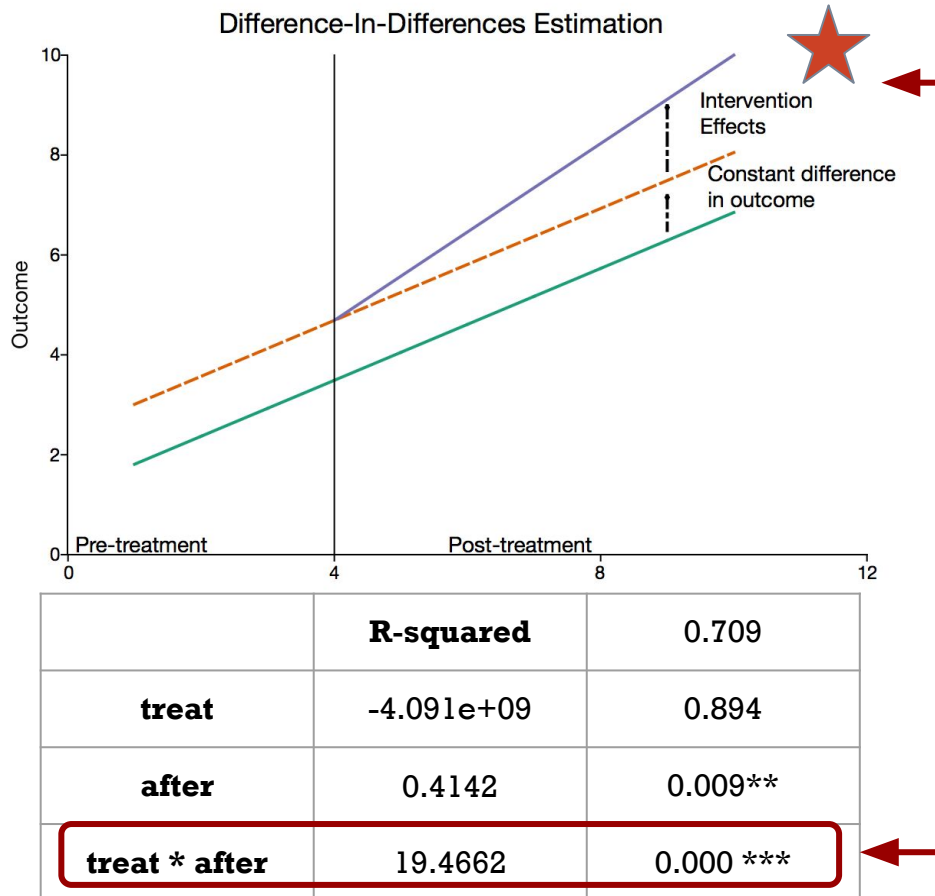
- **Treatment Group:**
  - Advertised most of the time
  - Placement of ads begins around March

- **Control Group:**
  - For the most of the time, not advertised
    (More than 95% of sales days have no advertising activities)

Sales Trend

Note: Chose March 15th as the policy shock date, Treatment group line was scaled
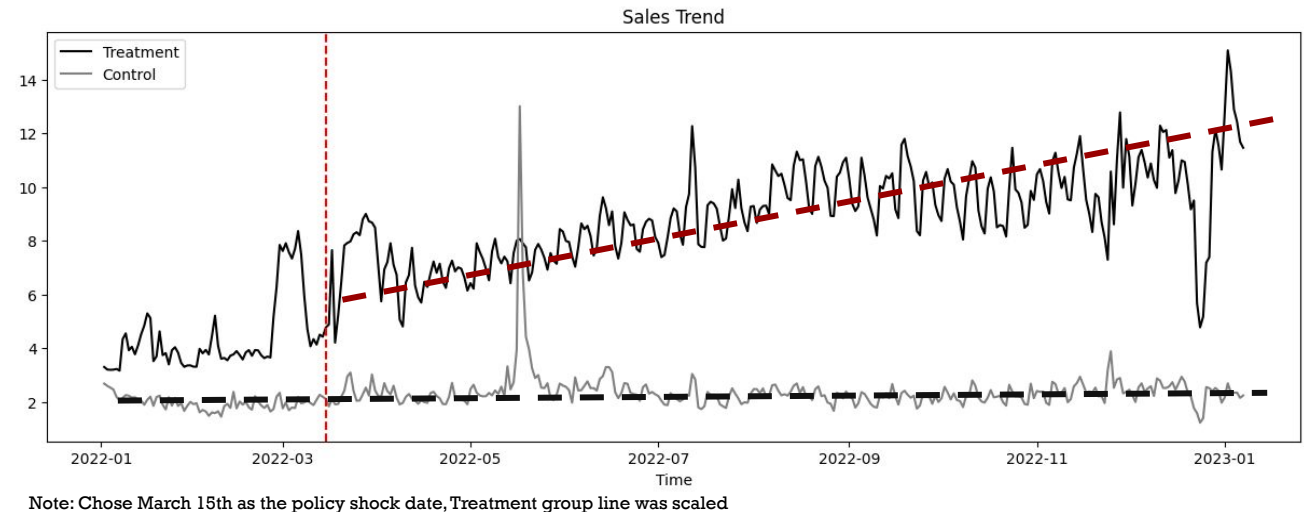
☹ **Problems: Unsatisfied Assumptions => Unreliable Results**
  - Violation of the parallel trends assumption due to the presence of selection bias
  - Lack of accurate correspondence of individual products with the ads start time

Staggered DID Model: Addressing time issue in ads effect
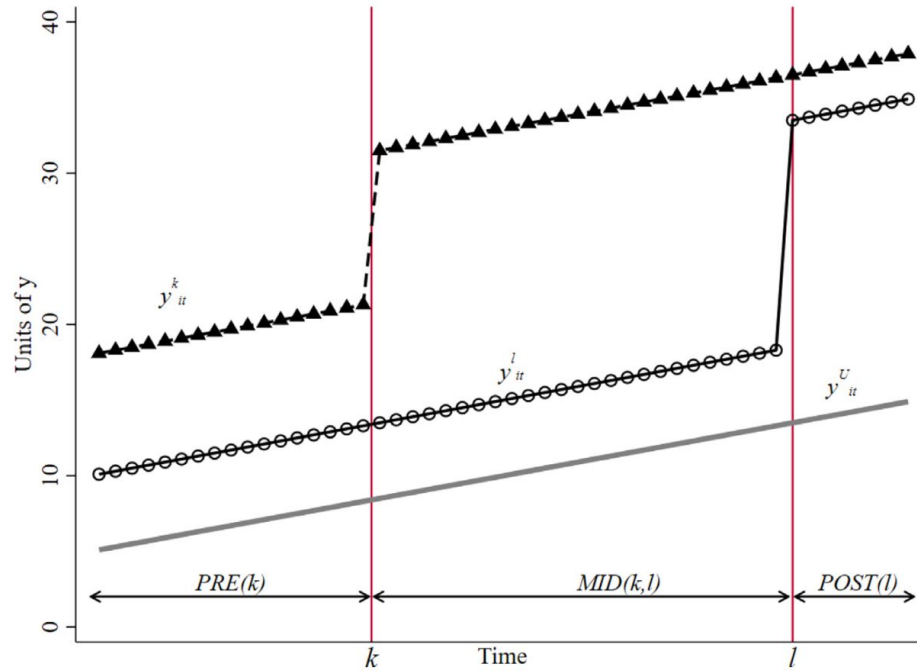
	R-squared	0.010
ads	5.4075	0.000 ***

- Often the case, a policy is introduced in many different individuals during many different time periods.

Distribution of 'First Category' for Products in Staggered DID Model
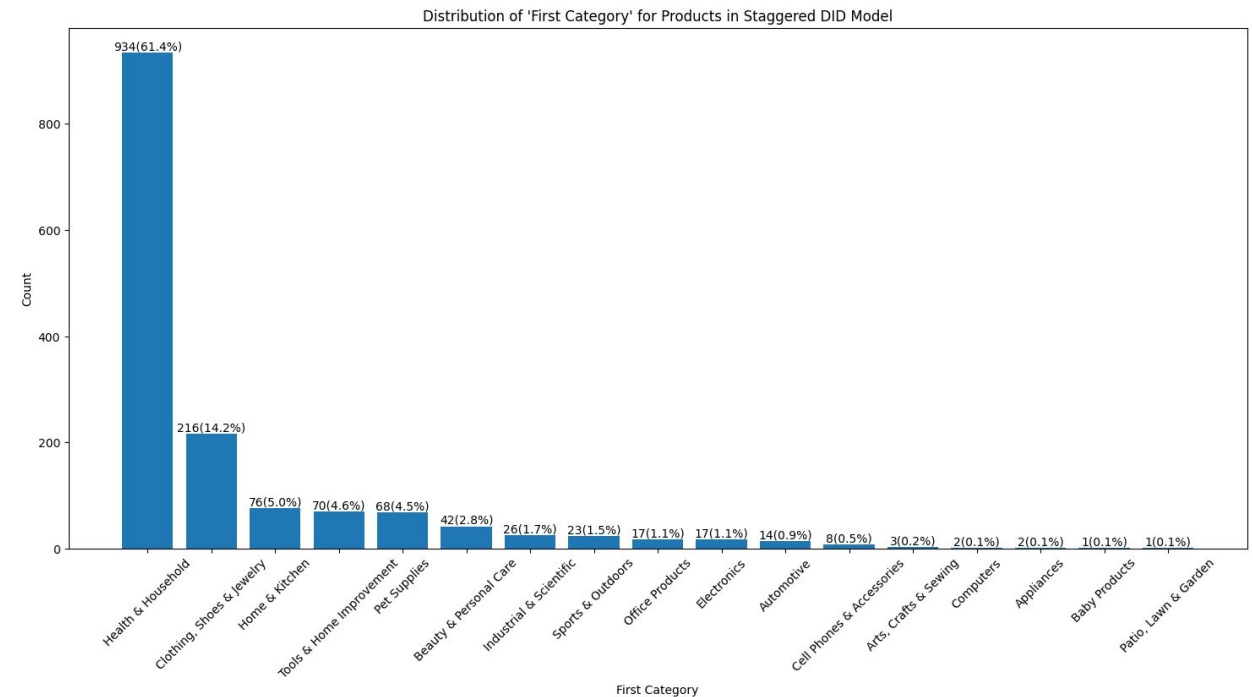
☹ **Problems: Only General Results**
  - Multiple categories → Lack Comparability
  - What if I want to know the ads effect on **individual products**?

PSM-DID Model: Exploring ads effect on individual products

Propensity Score Matching

Population with varying characteristics

Study Group with Matching

● Treatment ● Control

Treatment

pure encapsulations
B6 Complex
With Metafolin® L-5-MTHF;
Broad-spectrum B vitamin support
with enhanced vitamin B6†
Gluten-free, Non-GMO
& Hypoallergenic
Dietary Supplement
60 CAPSULES

Visit the Pure Encapsulations Store
4.7 ★★★★☆ ⌄   596 ratings
| 7 answered questions
50+ bought in past week

Price: $27.50 ($0.46 / Count)

Control

Brand: Holland & Barrett
4.2 ★★★★☆ ⌄   4 ratings
$14.39 ($0.14 / Count)

HOLLAND & BARRETT
Complete B
Vitamin B-Complex

Visit the Vital Nutrients Store
4.7 ★★★★☆ ⌄   404 ratings
| 14 answered questions
50+ bought in past week

$23.90 ($0.40 / Count)

VITAL NUTRIENTS
B-Complex
DIETARY SUPPLEMENT
60 VEGETARIAN CAPSULES

9

Regression Discontinuity Design: Enhancing the robustness of DID results
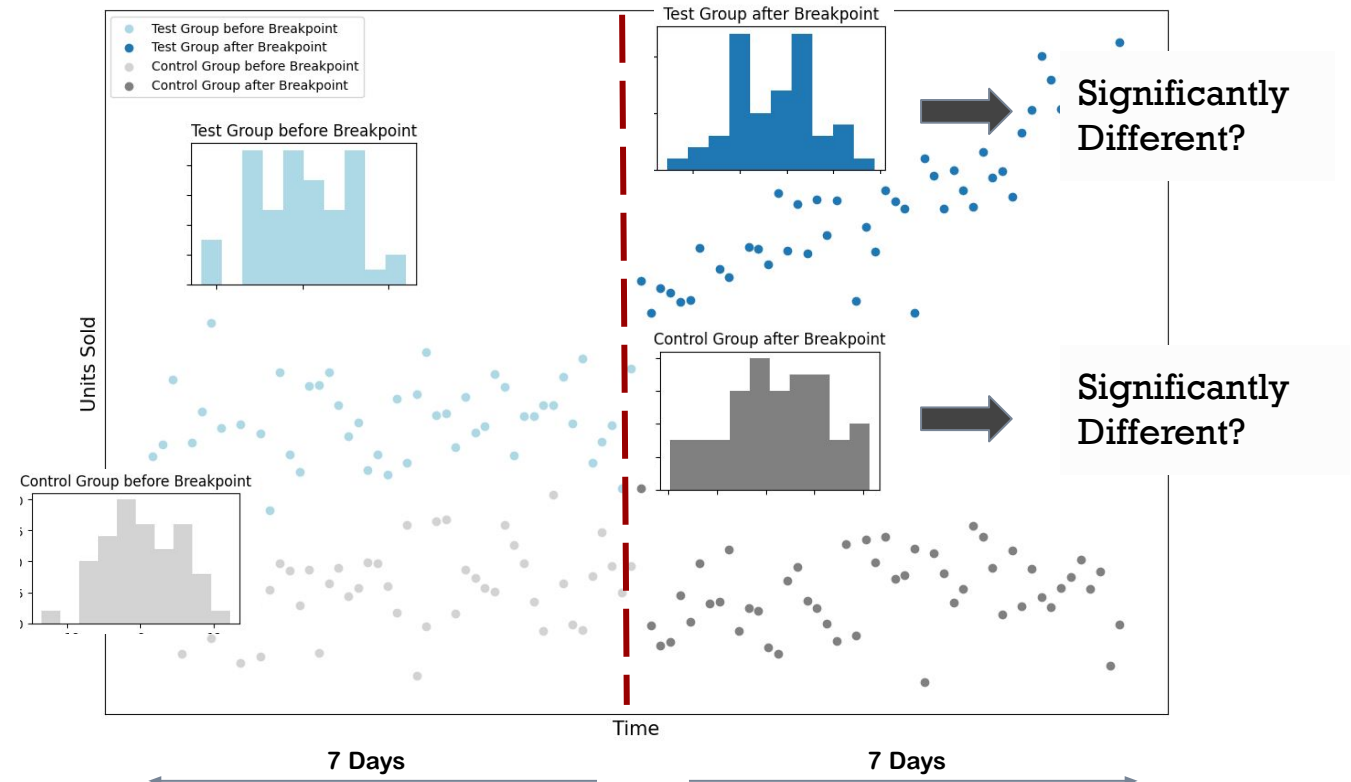
Core Idea of RDD

The distribution of observations near a threshold may exhibit a discontinuity

Core Idea of Tests

- Identify the 'discontinuity' where a specific advertisement starts or stops for the treat product
- Select data for both treat and control product for a 7-day period before / after the breakpoint
- Test the consistency of the distribution

Test Group before Breakpoint
Test Group after Breakpoint
Control Group before Breakpoint
Control Group after Breakpoint

Test Group before Breakpoint

Test Group after Breakpoint

Control Group after Breakpoint

Control Group before Breakpoint

Units Sold

Time

7 Days | 7 Days

Significantly Different?

Significantly Different?

Normality → ✓ → Homogeneity → ✓ → Sample t-test

Wilcoxon Signed-Rank Test

03

Matching Process

Keywords: Information Collection, Matching

Product Classification

First   Second   Last

Health & Household › Vitamins, Minerals & Supplements › Amino Acids › Creatine

Product Type

Nutricost Creatine Monohydrate Micronized Powder 500G, 5000mg Per Serv (5g) - Micronized Creatine Monohydrate, 100 Servings

Visit the Nutricost Store

4.7 ★★★★½ ⌄   19,257 ratings

Ratings & Reviews

| 104 answered questions

#1 Best Seller ◀ in Creatine Nutritional Supplements

Price: **$22.05** ($1.25 / Ounce)

Coupon: ✓ 5% coupon applied at checkout. Subscribe & Save orders only.   Shop items › | Terms

Redeem   **Save 10%** on 2 select item(s) promo code:
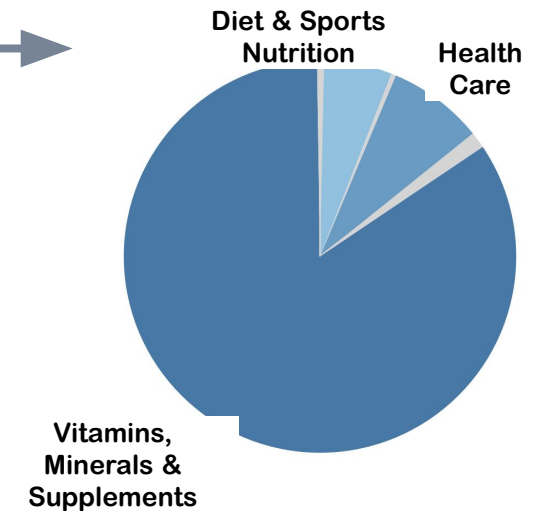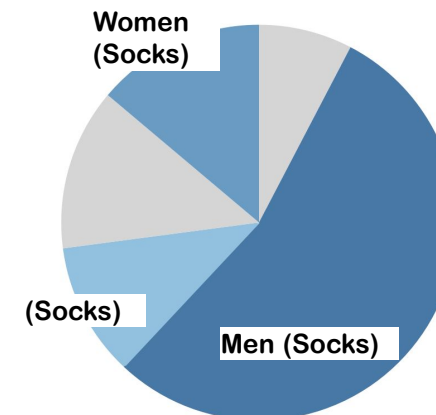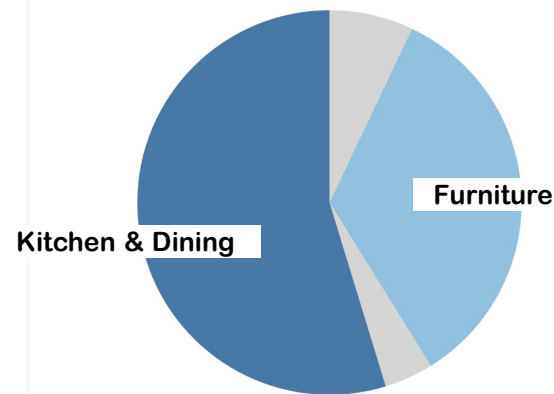
ESUPPS10   Shop items

S Best price   **S** +

2 VIDEOS

Roll over image to zoom in

Product Classification

- Analysis is limited to the **top 3** categories:
  - Health & Household, Clothing, Shoes & Jewelry, Home & Kitchen

Distribution of 'First Category' of Treatment Group Products

First Category

Category	Count
Health & Household	1,266
Clothing, Shoes & Jewelry	484
Home & Kitchen	170
Pet Supplies	87
Tools & Home Improvement	71
Beauty & Personal Care	61
Sports & Outdoors	43
Patio, Lawn & Garden	39
Electronics	29
Industrial & Scientific	28
Office Products	22
Automotive	17
Null	15
Cell Phones & Accessories	13
Baby Products	9
Grocery & Gourmet Food	4
Arts, Crafts & Sewing	4
Computers	2
Appliances	2
Food Service Equipment &..	1

Pie charts:
- Home & Kitchen: Kitchen & Dining, Furniture
- Clothing, Shoes & Jewelry: Women (Socks), Men (Socks), (Socks)
- Health & Household: Diet & Sports Nutrition, Health Care, Vitamins, Minerals & Supplements

13

Matching Procedure

- Matched products based on **the similarity score** (or **propensity score**).
- Similarity score is calculated between each product using **Model** and **Manual** Method.

```python
num_features = ['average_units_noads', 'Price', 'rating', 'ratings']
dummy = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']
```

Basic Information of Each Product

Sales Information of Each Product

Python

Treatment Group

First Category
Health & Household › **Second Category**
Vitamins, Minerals & Supplements › Amino Acids › **Last Category**
Creatine

Method 1
Model: **Probability**

Logistic Regression

(Top 3 Category)

Similarity Score

KNN

Minimize

Matching

Select Best Matched

DID

Method 2
Manual Calculation

Linalg Method +
Jaccard Similarity

- Prioritizes matching within the smallest category.

Control Group

14

04

Results & Conclusion

Keywords: Incremental Revenue, Other Insights

Examples

Health & Household

Health & Household › Health Care › Alternative Medicine › Flower Essences

Total Units with Ad Annotation

Treat Asin

Control Asin(Manual)
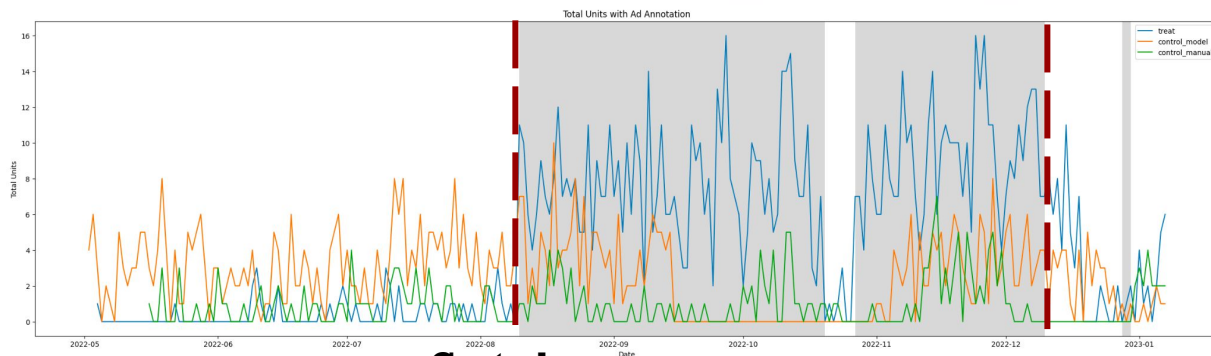
Bach Original Flower Remedies, Aspen for Apprehension and Security, Natural Homeopathic Flower Essence, Holistic Wellness and Stress Relief, Vegan, 20mL Dropper

ASIN
B000FLF9NM

BRAND
Bach

PRICE
$17.57

EST DAILY IMPRESSIONS
12,599

EST DAILY CLICKS
90

OF RATINGS
339

AVG RATING
★ 4.5

Bach Original Flower Remedies, Honeysuckle for Embracing the Now, Natural Homeopathic Flower Essence, Holistic Wellness and Stress Relief, Vegan, 20mL Dropper
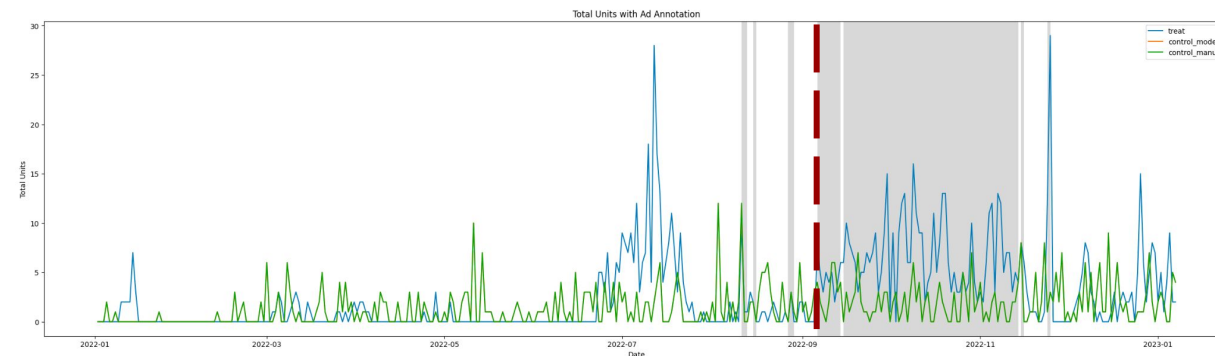
ASIN
B000WT6A8K

BRAND
Bach

PRICE
$16.06

EST DAILY IMPRESSIONS
5,641

EST DAILY CLICKS
32

OF RATINGS
120

AVG RATING
★ 4.5

ads	R-squared	P-value
7.4752	0.540	0.000***

	Treat	Control
Robustness Test	Y	N

Clothing, Shoes & Jewelry

Clothing, Shoes & Jewelry › Men › Clothing › Active › Athletic Socks

Total Units with Ad Annotation

Treat Asin

Control Asin(SAME)

Stance Basic 3 Pack No Show

ASIN
B08DL3S2D6

BRAND
Stance

PRICE
$14.44

EST DAILY IMPRESSIONS
13,753

EST DAILY CLICKS
33

OF RATINGS
990

AVG RATING
★ 4.6

Feetures Elite Light Cushion Quarter - Running Socks for Men & Women - Targeted Compression - Moisture Wicking

ASIN
B07H3DB43D

BRAND
Feetures

PRICE
$18.04

EST DAILY IMPRESSIONS
6,264

EST DAILY CLICKS
72

OF RATINGS
337

AVG RATING
★ 4.7

ads	R-squared	P-value
4.3722	0.235	0.000***

	Treat	Control
Robustness Test	Y	N

16

Thank you for watching.