

Advertising Incrementality Measurement using Controlled Geo-Experiments: The Universal App Campaign Case Study

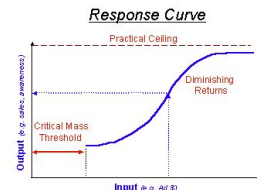
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Yahoo! Research - Verizon Media
Marketing Data Science - Uber Technologies



The Problem: Measure Channel Incrementality

- **The Problem:** Measure **channel spend effectiveness** for optimal budget allocation and planning.
- **Constraints:** Due to **limited access to user level traffic**, advertisers are left with aggregate time series KPI signals and targeted spend action levers.
- **Typical Benefits:** Time-series based Media Mix Models to estimate the **channel response curve** at different spend levels, **calibrated with experiment results**



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Controlled Geo-Experiment Design

- **Market match** testing
- **Spend cut** intervention
- **Synthetic Control** based Causal Estimation



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Causal Estimation

- We use a **Bayesian structural** framework with time series and a regression component from the control market conversions to **predict the treatment conversions** (synthetic control).

Structural Equation

Time Series trend



Control Market Predictor

$$y_t^{(treat)} = F_t \theta_t + x_t^{(control)T} \beta + \epsilon_t, \quad \epsilon_t \sim N(0, \sigma^2),$$
$$\theta_t = G_t \theta_{t-1} + \omega_t, \quad \omega_t \sim N(0, W),$$

Market Best Match: A/A tests

• Market match testing

Best Pair selection
given the
conversion and
estimation method

A/A test estimation:
Given Causal Estimation
Framework

Filter Best Pairs and
Parameters: tightest and
interval with zero effect

Algorithm 1 Control/Treatment Market Pair Selection

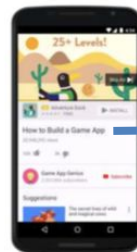
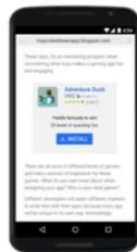
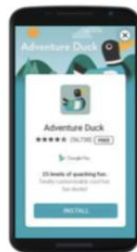
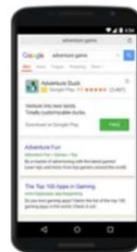
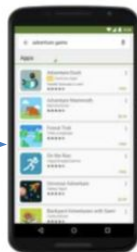
1: Ω : Set of Markets to consider
 2: Φ : Set of placebo intervention times
 3: Δ_t : Time length of historical data
 4: Δ_{t_i} : Time after placebo intervention
 5: **for all** treatment market: $m \in \Omega$ **do**
 6: **for all** control market: $n \in \{\Omega - m\}$ **do**
 7: **for all** intervention time: $d \in \Phi$ **do**
 8: Fit the synthetic control model of Eq 1:
 9: **Find** Θ^s , $s = 1, \dots, N_s$, given $\{y_{d-\Delta_t:d-1}^{(m)}, x_{d-\Delta_t:d-1}^{(n)}\}$
 10: **Predict** $\hat{y}_{t_i}^{s(m)}$, $\forall s \in \{s = 1, \dots, N_s\}$ after intervention,
 $\forall t_i \in \{d, \dots, d + \Delta_{t_i}\}$
 11: **Estimate** Credible Intervals (CI) $lift_{cum(d+\Delta_{t_i})}$, Eq 3
 12: **end for**
 13: **end for**
 14: **$n^*, d^* \leftarrow$** tightest CI that include $lift_{cum(d+\Delta_{t_i})} = 0$
 15: **Append** best control/treatment/time $V = \{V, (m, n^*, d^*)\}$
 16: **end for**
 17: **return** V

Estimation Parameters:
Markets, Intervention
times, Train/follow-up
Length

Marketing Causal Effectiveness: UAC Case Study

- **Universal App Campaigns (UAC)** unify Google inventory across its properties (GSN, GDN, YouTube, GP).
 - UAC campaigns are **managed by the ad network**
 - UAC is a channel-mix **limited customization levers**

User level randomization is not possible for testing



Is the channel incremental?

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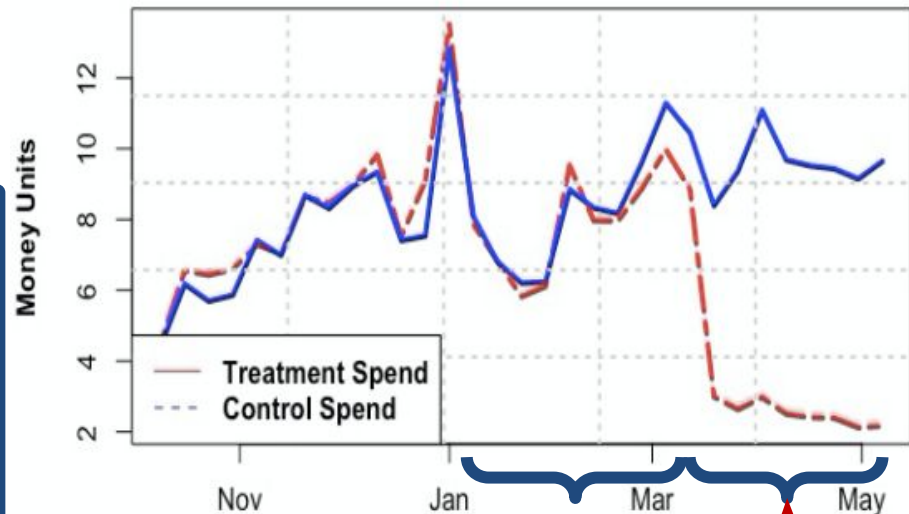
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UAC Incrementality: Intervention

- Given **treatment/control pairs** and the **estimation method**, we execute the experiment

1. Cost-per-attributed-signup (CPA) **stabilization** both groups
2. **Suspend** spend for treatment market

UAC Spend in money units



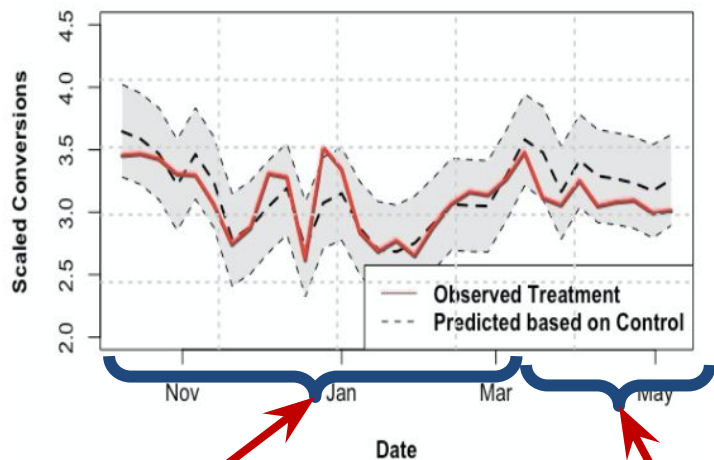
Stabilization, same CPA
in both markets
01/15 - 03/12

Actual Intervention:
Treatment Spend cut
03/19 - 05/13

UAC Incrementality: Effect on Weekly Conversions

- Consistently **lower predictive (synthetic control) treatment conversions** than observed

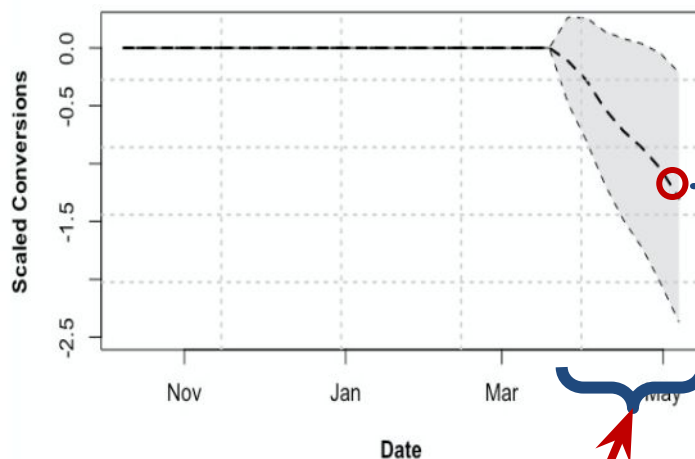
UAC Predicted vs Observed Conversions



Training period:
09/09 - 03/12

Intervention period.
Predictive vs observed
03/12 - 03/15

Cumulative Effect on Conversions



Cumulative effect
and 95% credible
intervals

Conversion Lift:
-6.57%

Spend Lift:
-72.33%

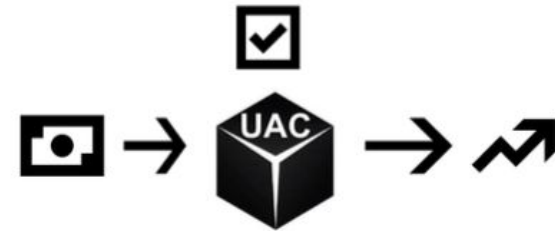
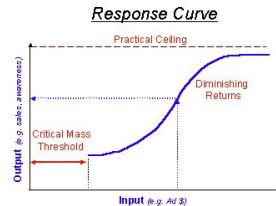
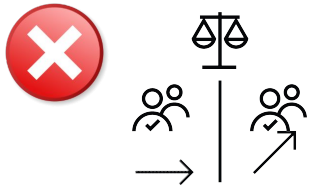
Cost per Incremental
Scaled conversion:
**39.30 money
units**

Conclusion Discussion

Comparisons between aggregate market conversions require **large intervention effects (spend)** since we are unable to identify users not exposed to the ads leading to **less precision**.

Rigorously designed experiments provide valuable data to build **channel cost curves of incremental conversions** and to calibrate Media Mix Models for optimal spend allocation

We have found evidence that **UAC provides incremental value** as a marketing channel, in spite of the **limited customization levers**



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Thank you!!