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

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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.
Controlled Geo-Experiment Design

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

Find best Market Pair Matching → Spend Efficiency Stabilization → Marketing Spend Cut in Treatment → Measure the Effect on Weekly Conversions
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).

\[
\begin{align*}
    y_t^{(treat)} &= F_t \theta_t + x_t^{(control)}T \beta + \epsilon_t, \\
    \theta_t &= G_t \theta_{t-1} + \omega_t, \\
    \epsilon_t &\sim N(0, \sigma^2), \\
    \omega_t &\sim N(0, W),
\end{align*}
\]
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: $\Omega$: Set of Markets to consider
2: $\Phi$: Set of placebo intervention times
3: $\Delta_t$: Time length of historical data
4: $\Delta_{t_i}$: 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 $\Theta^s$, $s = 1, \ldots, N_s$, given $\{y_{d - \Delta_t; d - 1}, x_{d - \Delta_t; d - 1}\}^{(m)}$  
10: Predict $\hat{y}^{(m)}_{s, t_i}$, $\forall s \in \{s = 1, \ldots, N_s\}$ after intervention, $\forall t_i \in \{d, \ldots, d + \Delta_{t_i}\}$
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?
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

![Graph showing 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

Training period: 09/09 - 03/12

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

Conversion Lift: -6.57%

Spend Lift: -72.33%

Cost per Incremental Scaled conversion: 39.30 money units

Cumulative effect and 95% credible intervals
Compositions 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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**Conclusion Discussion**

Response Curve

![Response Curve](image)
Thank you!!

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