A/B Testing for Homepage Promotion Optimization

1. Background & Objective

Mobile coffee ordering apps rely heavily on homepage promotions to drive frequent purchases. Small changes in promotional card design—such as clearer messaging, price anchoring, or contextual framing—can meaningfully influence user engagement and downstream conversion.

The objective of this experiment is to evaluate whether improving homepage promotional card content can increase user engagement and conversion performance, measured by:
- Click-through Rate (CTR) as the primary metric
- Conversion Rate (CVR) as a secondary downstream metric

2. Data Disclaimer & Experiment Design

This project is based on simulated and anonymised user-level data for portfolio purposes. The experiment is designed to replicate a real-world A/B testing workflow commonly used in consumer app operations.

Users are randomly assigned to Control (A) and Treatment (B) groups with a 50/50 traffic split. Click-through is a prerequisite for conversion, and conversion probability varies by user type (new vs returning) and time slot (morning, afternoon, evening). The Treatment group is assumed to perform better due to clearer value communication through contextual messaging and explicit price anchoring.

Figure 1. Conceptual mockup of Control (A) and Treatment (B) promotional card designs.

3. Metrics & Sample Size Rationale

CTR is defined as clicks divided by exposed users and is treated as the primary metric, as it reflects early user engagement and typically requires fewer samples to detect meaningful change. CVR is defined as completed orders divided by exposed users and is treated as a secondary downstream metric.

Sample size estimation is based on CTR assumptions: a baseline of 8.5%, a target of 10.0% (+1.5pp minimum detectable effect), a 5% significance level, and 80% statistical power. This yields a minimum requirement of approximately 5.8k users per group. To support secondary metric analysis, segmentation, and robustness checks, the final simulated sample size was increased to 30,000 users.

4. A/B Test Results

Overall performance comparison between Control and Treatment groups is shown below.

Group	Users	CTR	CVR	Lift vs Control
Control (A)	14,990	8.50%	1.69%	—
Treatment (B)	15,010	9.47%	2.30%	+0.97pp CTR / +0.61pp CVR

Two-sample proportion Z-tests indicate statistically significant improvements in both CTR ($p = 0.003$) and CVR ($p < 0.001$). Although the experiment was powered on CTR, the consistent and significant CVR uplift suggests meaningful downstream business impact.

5. Segmentation Analysis (New vs Returning Users)

Segment-level CVR comparison highlights heterogeneous treatment effects.

User Type	Control (A) CVR	Treatment (B) CVR	Interpretation
New users	1.40%	1.83%	Moderate uplift
Returning users	1.90%	2.61%	Strong, statistically significant uplift

Returning users respond more strongly to the Treatment design, suggesting that price anchoring and contextual messaging are particularly effective for users with prior brand familiarity.

6. Business Interpretation & Recommendations

The improved promotional card likely performs better because clearer contextual messaging and explicit price anchoring reduce cognitive load and improve value perception. Higher CTR increases purchase opportunities, while CVR uplift confirms genuine purchase intent.

Recommendations include rolling out the Treatment design as the default homepage promotion, running follow-up experiments with user-type and time-slot personalisation, and extending evaluation to GMV uplift and incremental subsidy ROI.

7. Limitations & Next Steps

This analysis is based on simulated data and assumes perfect randomisation and single exposure. Long-term effects such as user fatigue, repeated exposure, and retention are not modeled.

Next steps include deploying the experiment in a live environment, validating results across cities and promotion types, and tracking longer-term user behaviour.