

Part 2 - Experiment and metrics design

The neighboring cities of Gotham and Metropolis have complementary circadian rhythms: on weekdays, Ultimate Gotham is most active at night, and Ultimate Metropolis is most active during the day. On weekends, there is reasonable activity in both cities.

However, a toll bridge, with a two way toll, between the two cities causes driver partners to tend to be exclusive to each city. The Ultimate managers of city operations for the two cities have proposed an experiment to encourage driver partners to be available in both cities, by reimbursing all toll costs.

1) What would you choose as the key measure of success of this experiment in encouraging driver partners to serve both cities, and why would you choose this metric?

It can be assumed that Ultimate's goal, in line with making the most amount of money possible, is to serve as many people as possible. In order to do so, Ultimate is going to need many drivers that are readily available when the customer. However, if the drivers are not seeing riders and getting paid, they are likely to search for other options (deliver food, work for competition, etc..) If the question here is, how do we know that reimbursing all toll costs is working, then the key measure of success is **change in percentage of drivers willing to cross over to meet the demand/supply imbalance**. Essentially, when business dies down in one city, are drivers crossing over and working the other or are they still simply going home. This on its own is really difficult to figure out. This could be tracked through location data, the change of number of drivers to customers.

A number that Ultimate already has is surge prices. Surge pricing is a relationship between supply and demand. If there are more riders than drivers surge pricing comes into play, the fewer the number of drivers to the greater number of riders will result in more expensive rides or a higher surge price. If we see a reduction in the relative number of surge trips, so long the number of total trip increase it would be a sign that driver availability is increasing.

2) Describe a practical experiment you would design to compare the effectiveness of the proposed change in relation to the key measure of success. Please provide details on:

a) how you will implement the experiment

- Phase 1 (Before Reimbursement): Initially, collect data on surge pricing and the number of rides in both Gotham and Metropolis when drivers are not reimbursed for toll costs. This serves as the baseline.
- Phase 2 (After Reimbursement): After informing drivers about the toll cost reimbursement policy, collect data on surge pricing and the number of rides in both cities.

- Continue data collection for a significant period (e.g., several weeks) to account for variations in demand due to different days of the week, holidays, etc.

b) what statistical test(s) you will conduct to verify the significance of the observation

- Paired T-Test: To compare the means of surge pricing before and after reimbursement separately for both cities. This test will determine if there is a statistically significant difference in surge pricing.
- Chi-Square Test: To analyze the change in the percentage of drivers crossing the toll bridge after reimbursement. This will help assess if the reimbursement policy significantly increased driver availability in both cities.

c) how you would interpret the results and provide recommendations to the city operations team along with any caveats.

- Results Interpretation:
 - If the paired T-Test shows a statistically significant decrease in surge pricing in both cities after reimbursement, it suggests that the policy is effective in increasing driver availability during demand surges.
 - If the Chi-Square Test shows a significant increase in the percentage of drivers crossing the toll bridge after reimbursement, it indicates that the policy is successful in encouraging driver partners to serve both cities.
- Recommendations:
 - If the results are positive (i.e., surge pricing decreases, and the percentage of drivers crossing over increases), recommend continuing the toll cost reimbursement policy as it is likely benefiting both drivers and customers.
 - Monitor the data continuously to ensure the effectiveness of the policy over time.
 - Consider additional incentives or communication strategies if the results do not show the desired impact.
- Caveats:
 - External factors, such as changes in traffic patterns or seasonal variations, may affect the results. Ensure the experiment duration is long enough to account for such variations.
 - The success metric assumes that surge pricing accurately reflects supply and demand dynamics. Other factors, like driver preferences or acceptance rates, may also influence these metrics.
 - Customer feedback and driver surveys can provide additional insights into the driver experience and help refine the policy.

