We present the theoretical foundation for additive surge, Uber’s new driver surge mechanism.

**Theoretically** study driver incentives with dynamic pricing:
- Show multiplicative surge doesn’t work
- Develop a pricing scheme that does work

**Empirically** show that additive surge works in practical regimes of interest

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**Additive surge**

Key effect: lock in surge payments with long trips

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**Multiplicative surge**

Long trips increase in value with surge

Short trips do not

Both Long and Short equally increase in value!

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"I thoroughly dislike short trips ESPECIALLY when I’m picking up in a waning surge zone"

-- Anonymous driver
Theoretical results

Ignoring demand dynamics, naïve old pricing model works well.

**Theorem:** In the static model, Proportional pricing $w(\tau) = m\tau$ is incentive compatible.

With demand dynamics, it doesn’t.

**Theorem:** Proportional pricing may not be incentive compatible
If payout during surge is proportional, $w_1(\tau) = m_1\tau$

then $\sigma_1 = (T_1, \infty)$, i.e., rejecting short trips, is optimal

With demand dynamics, additive surge approximately works.

**Theorem:** For $\frac{P_0}{P_1} \in [C, 1]$, we have IC prices of the form:

$$w_i(\tau) = m_i\tau + z_i \left[ \frac{\lambda_{i\to j}}{\lambda_{i\to j} + \lambda_{j\to i}} \right] \left[ 1 - e^{-(\lambda_{i\to j} + \lambda_{j\to i})\tau} \right]$$
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\]

with \( m_0, m_1, z_1 \geq 0 \).

If surge is too valuable compared to non-surge on average, then cannot build fully IC prices.

We have \( m_i, z_i, C \) in closed form in terms of the model parameters.

Probability that a trip of length \( \tau \) that starts in state \( i \) ends in state \( j \)

Continuation value: compensate drivers for taking them out of surge.
Empirical goal: Estimate value of a request

How does accepting a given trip request change a driver’s expected earnings over the next 90 minutes?

- Receives + accepts trip $\tau$
- Observe actual driver earnings 90 minutes later
- Does not accept request
  - Use nearby driver as counter-factual
- Find a nearby driver match by checking trips that were recently completed with a nearby destination