2017 Meetings

NBER Market Design Working Group

# *Surge Pricing Solves the Wild Goose Chase*

Joint with

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*Uber*

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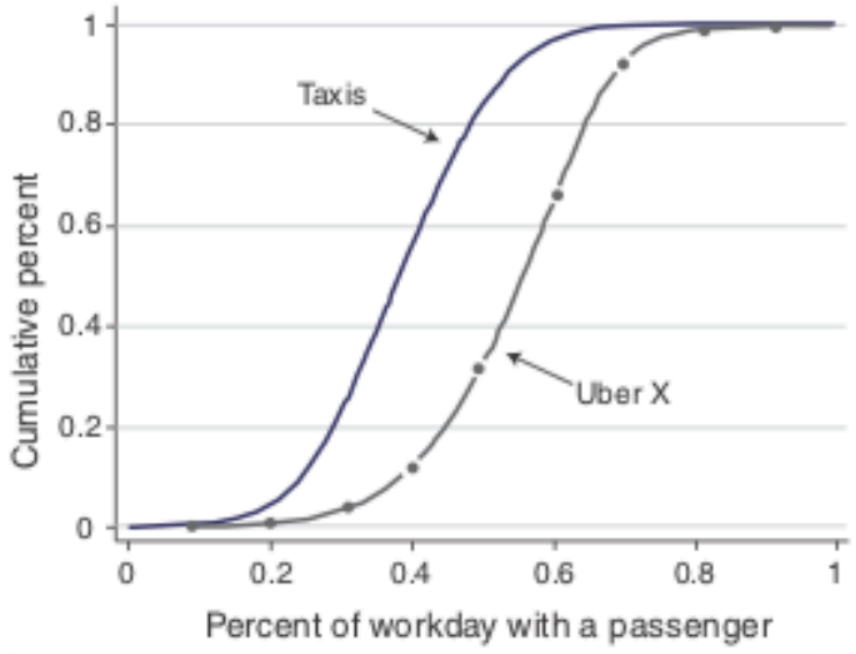
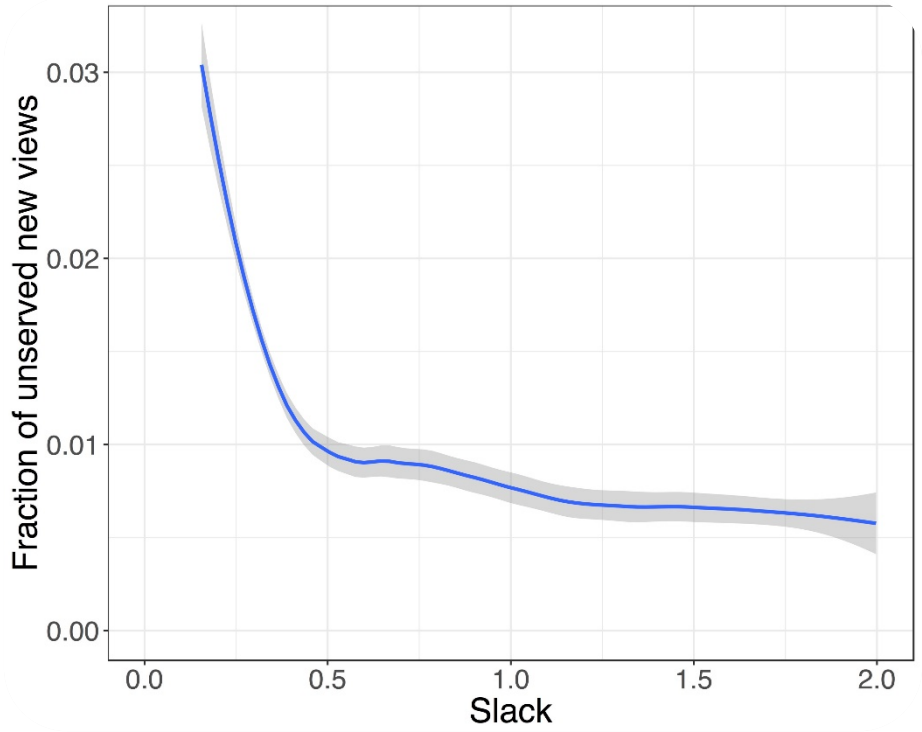
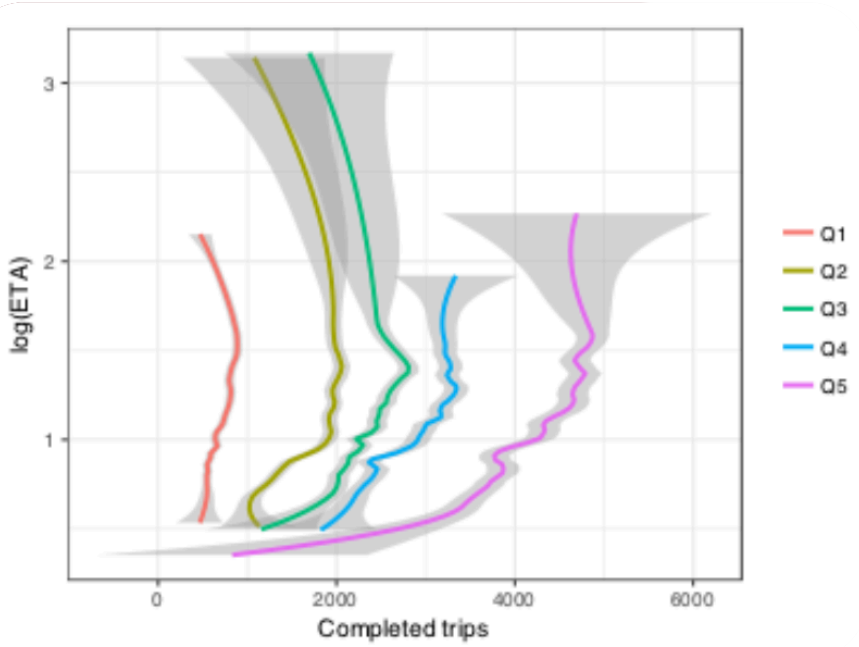
*Microsoft Research & Yale*

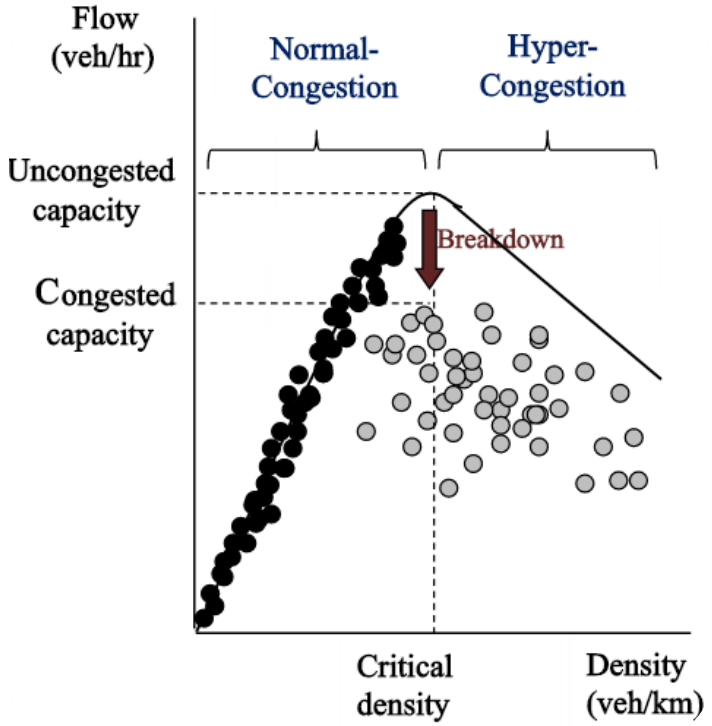
# Ride-hailing: powerful but fragile



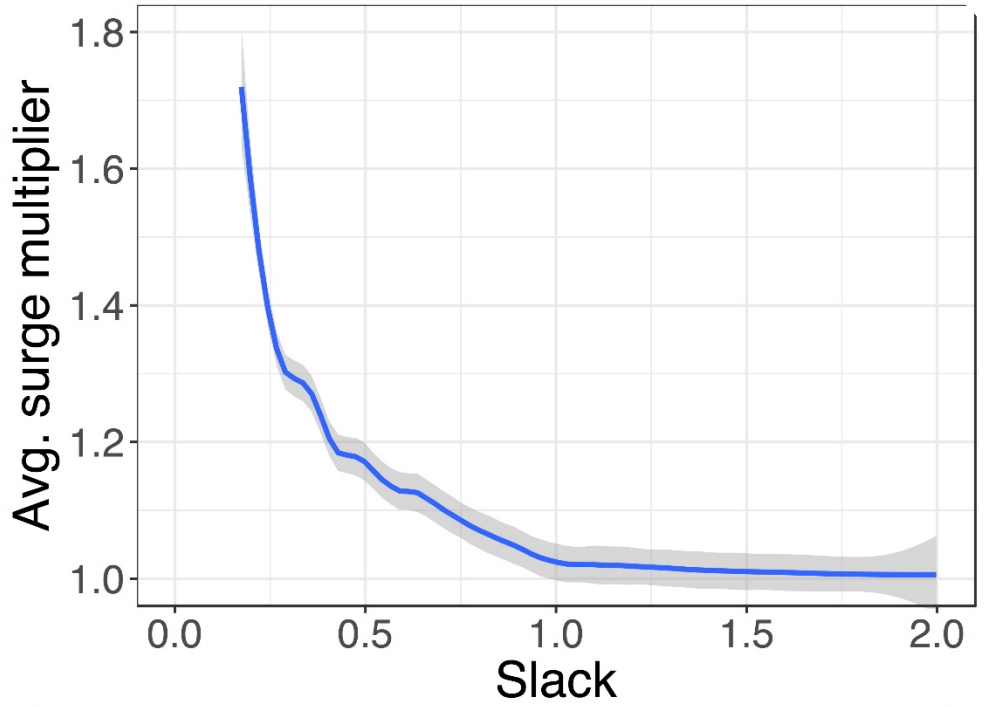



# Wild goose chases (WGCs) and Vickrey's hypercongestion



# Vickrey's "responsive pricing" / Uber's surge pricing as response



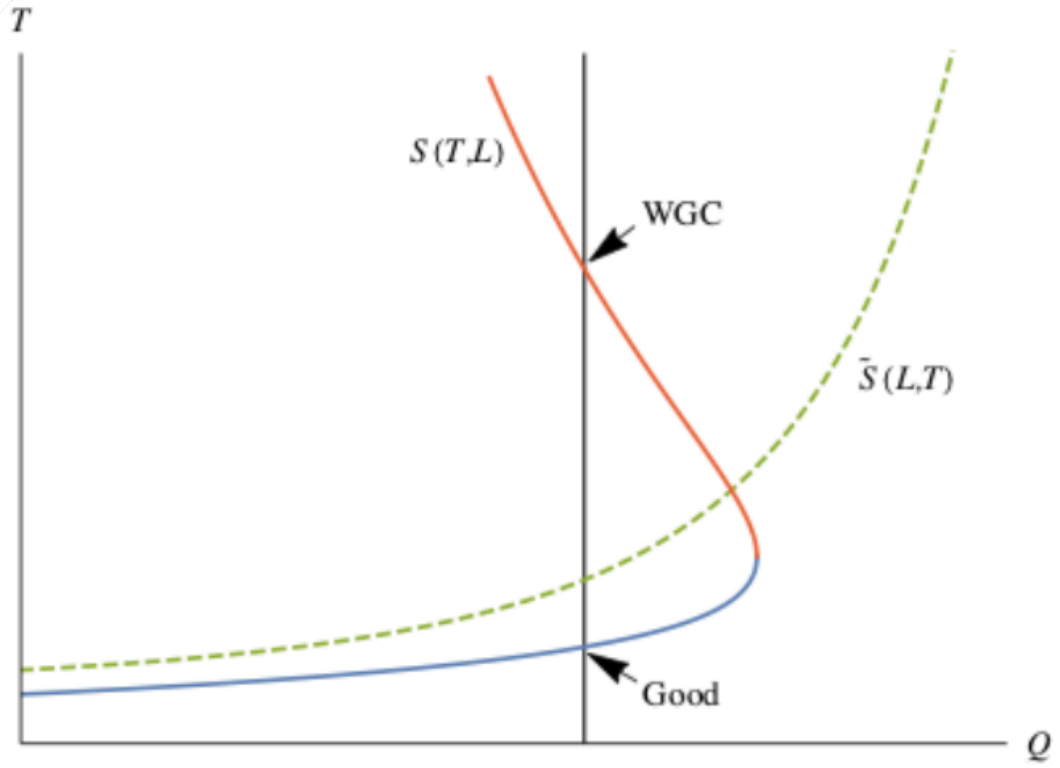
# Plan for talk

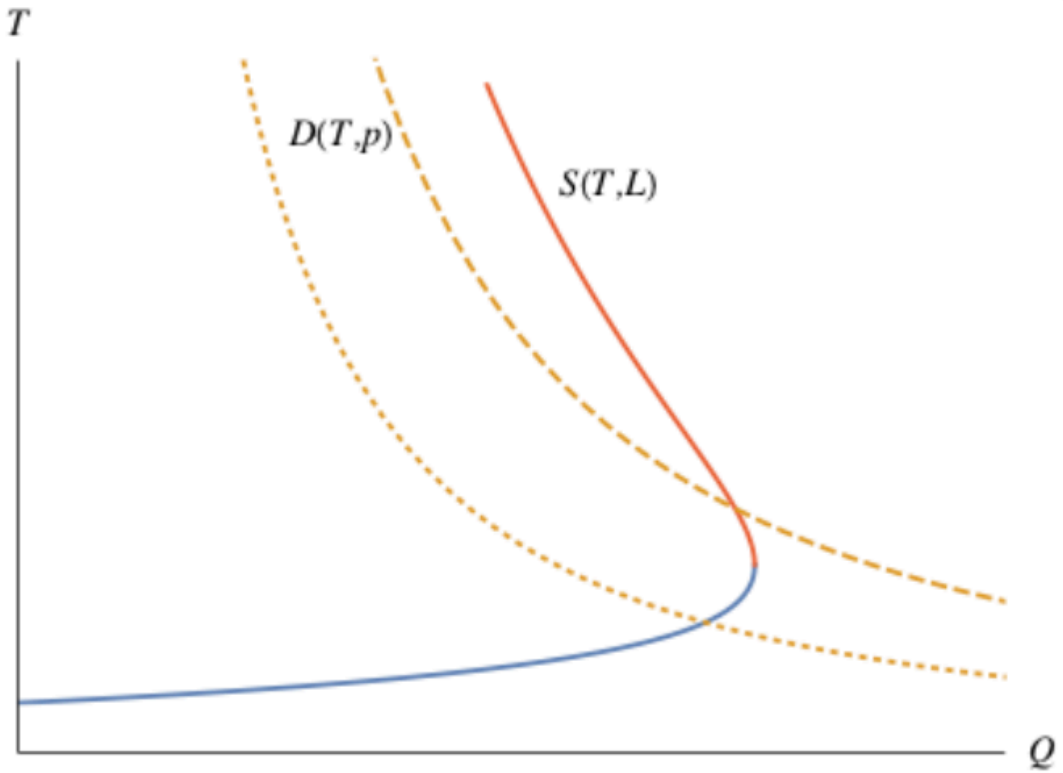
I. Describe model
II. Theoretical illustration of mechanism
III. Empirical illustration
IV. Welfare calibration and the costs of rigid pricing

# Main model features

- Homogeneous space
- Arbitrary topology (empirically measured)
- Driver supply driven by anticipated earnings per unit time
- Riders care both about wait, price
- Cars can be Idle, Delivering, or En Route
- Time spent En Route =waiting time $T(I)$ based on idle cars available (relative to demand)

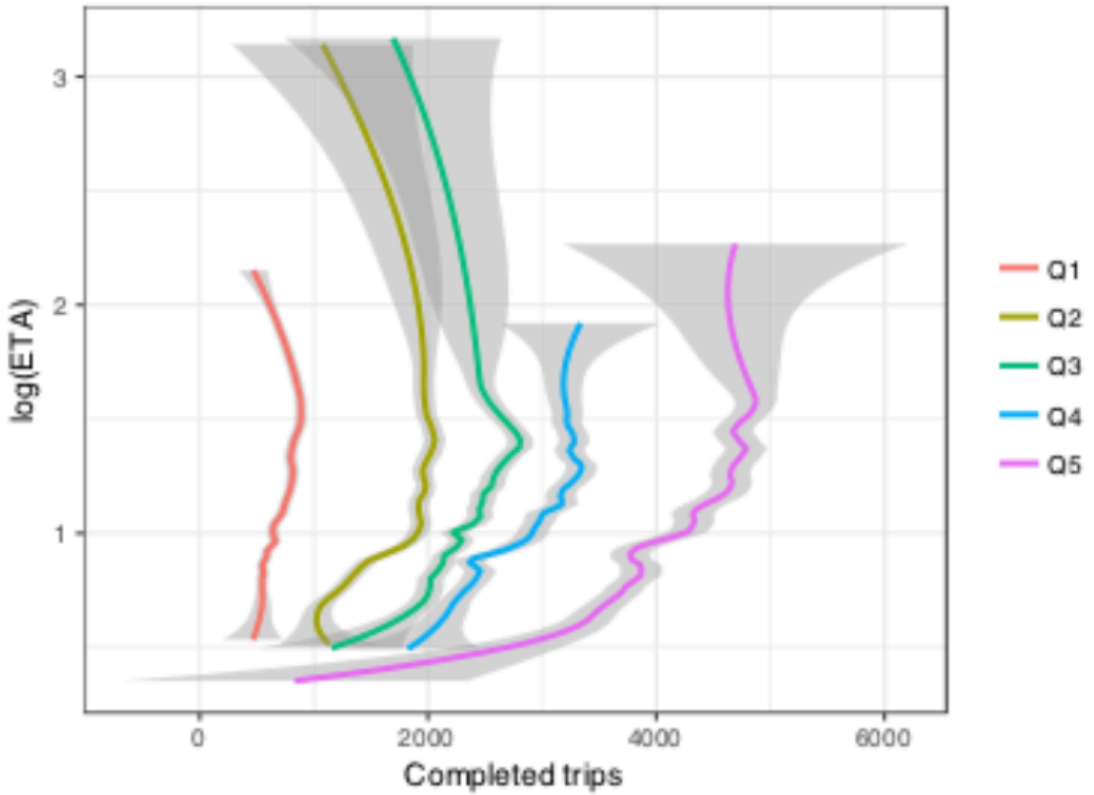
# Backward-bending “supply”



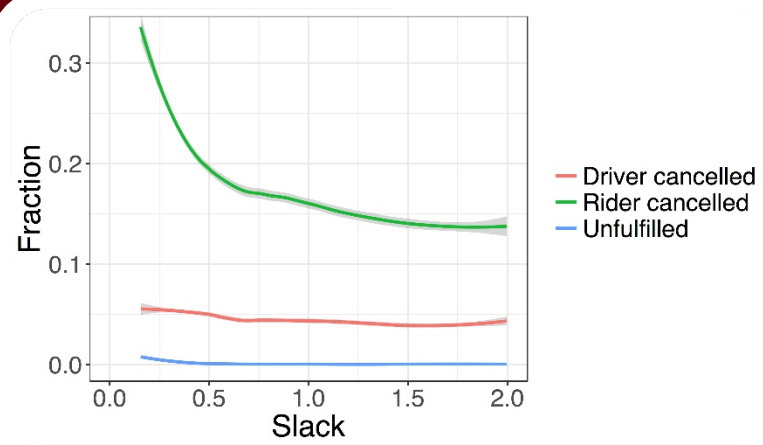



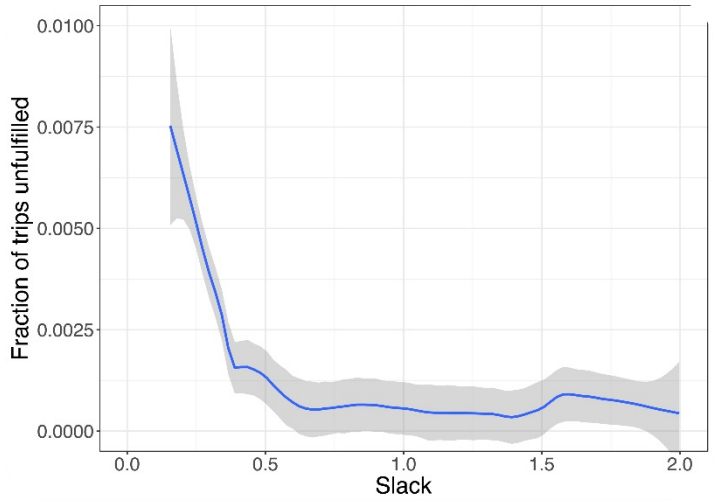
# Empirical analog

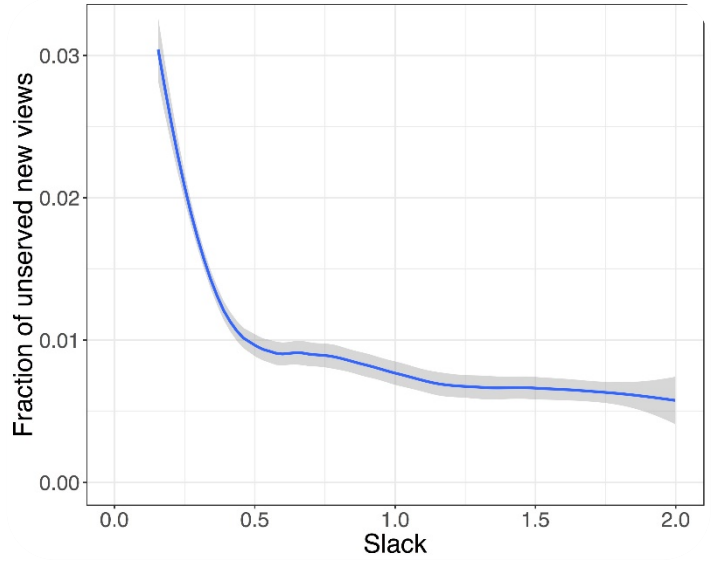
- Manhattan, December 2016-February 2017
- Observations: one 30-minute period



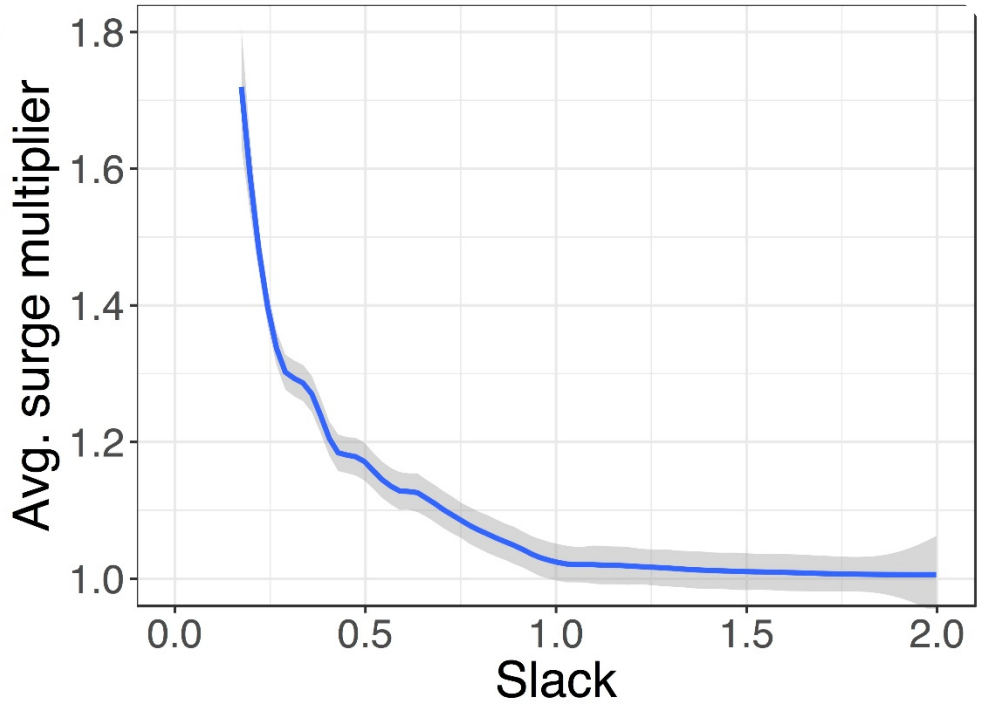
# Calibration implies breakdown at slack$\equiv \frac{Idle}{En\ Route} \approx .25-.5$



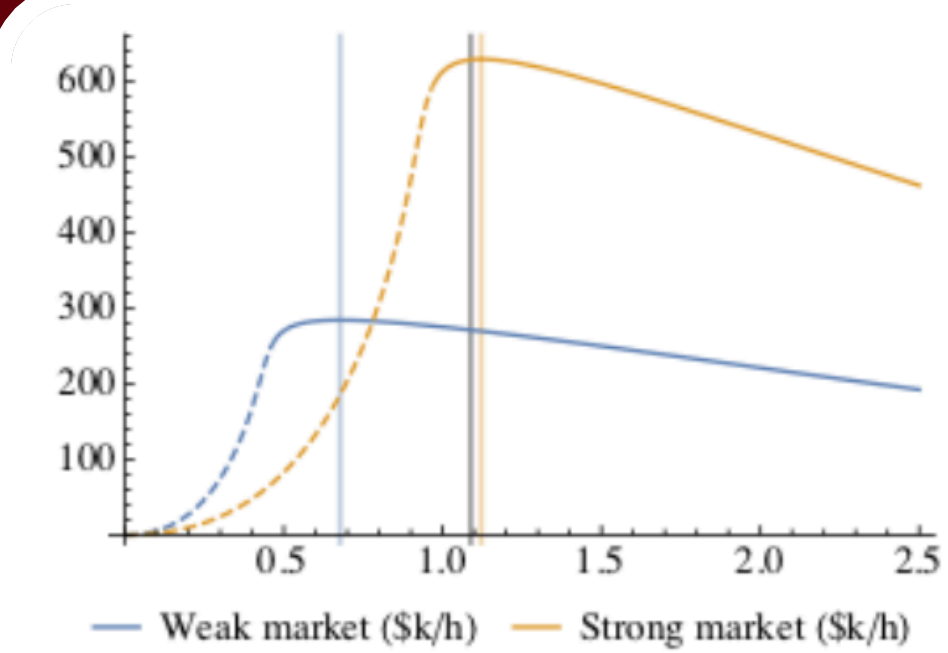
# Surge pricing appears to be mostly about this



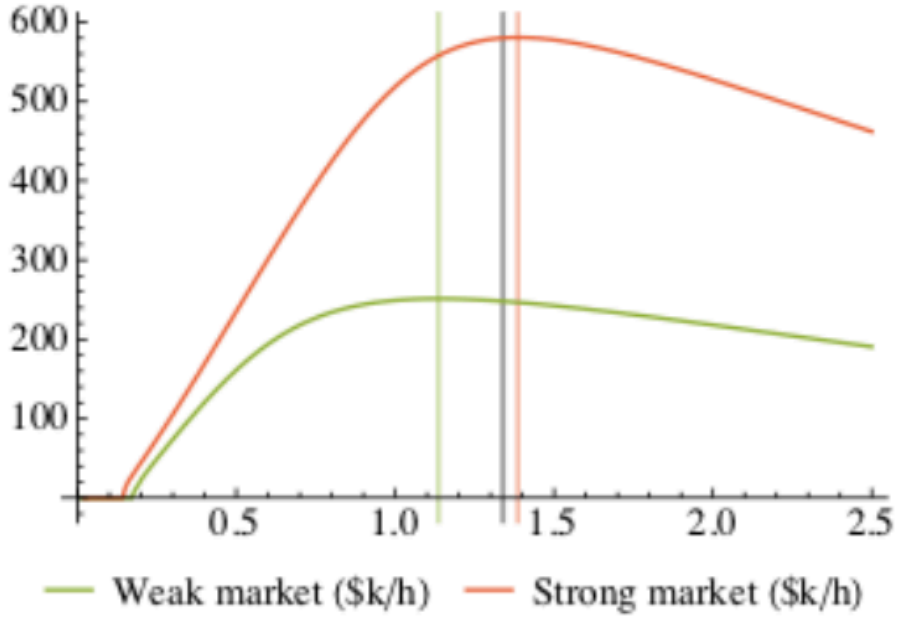
# Welfare calibration

- Max waiting time only time effect on demand
- Willingness-to-wait orthogonal to willingness-to-pay
- Pareto log-normal distribution of WTP, log-normal WTW, calibrate to other estimates
- Constant elasticity labor supply, calibrated to other Uber papers
- Space dynamics calibrated to time-distance data
- Busiest and calmest hours of the week
- 20% extraction

# Flexible pricing in street hail v. app-based hailing: 92nd v. 58th percentile




(a) Ride-hailing




(b) Traditional street-hail taxis

# Other solutions

- Rider queue
- Maximum dispatch radius

  Can help, but brand promise, lightly used
- Re-matching, forward dispatch more consistent

# Discussion

- Natural monopoly and regulation
- Regulation motive stronger with pool
- Idle car externality and free riding by competition
- Road congestion externalities

For future research:

- Spatial and temporal dynamics (JC)
- Integrating with traffic congestion
- Explicit competition