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Webinar: The Effects of Demand-Responsive Parking on Transit Usage and Congestion: Evidence from SFpark

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The effects of demand-responsive parking on transit usage and congestion: Evidence from SFpark

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Demand-responsive parking and SFpark

- Parking is a major problem, especially in big cities (Shoup 2011)
 - Inefficient and under-priced
- Traditionally use flat meter rates or short time limits
 - Hard to enforce
- Differentially price parking based on occupancy
 - Goals: Use parking spaces more efficiently by increasing turnover and availability

San Francisco and concerns of parking

- San Francisco County grew by 7% (or 60,000 people) between 2010 and 2015
- 2015 SFMTA survey on motivation to drive
 - Parking price and distance to destination from parking
 - 50% considered “free or cheap” parking prices as strong motivator to drive
 - Parking management policies affect transportation mode choice

Demand-responsive parking and SFpark

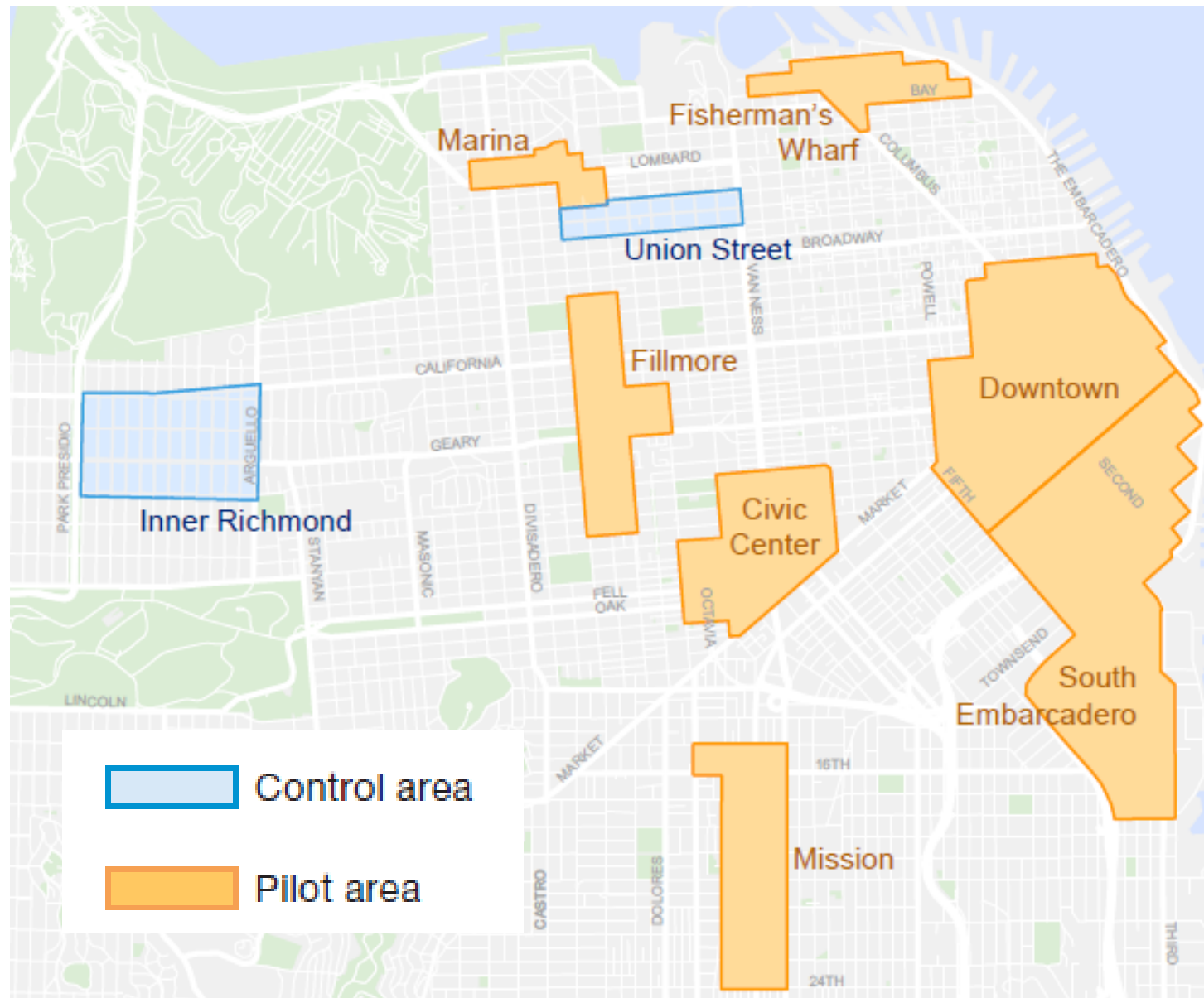
- SFpark: Pilot program started in July 2011
 - Vary price across time and blocks
 - Time bands: 7am-12pm, 12pm-3pm, 3pm-6pm, after 6pm
 - Weekdays vs. weekends
 - Rate adjustment periods (8 weeks)
- Made payments easier, extended time limits, etc.

> 80%	60-80% (target)	30-60%	< 30%
+\$0.25/hr	\$0/hr	-\$0.25/hr	-\$0.50/hr

Previous literature

- Small empirical literature due to scarce data
- SFpark: Publicly available data on price and occupancy for on-street parking
 - SFMTA (2014): Pilot evaluation between 2011 and 2013
 - SFpark increased parking availability
 - Millard-Ball, Weinberger, & Hampshire (2014): SFpark moved occupancy on blocks closer to target occupancy range

Data from SFpark's pilot evaluation program

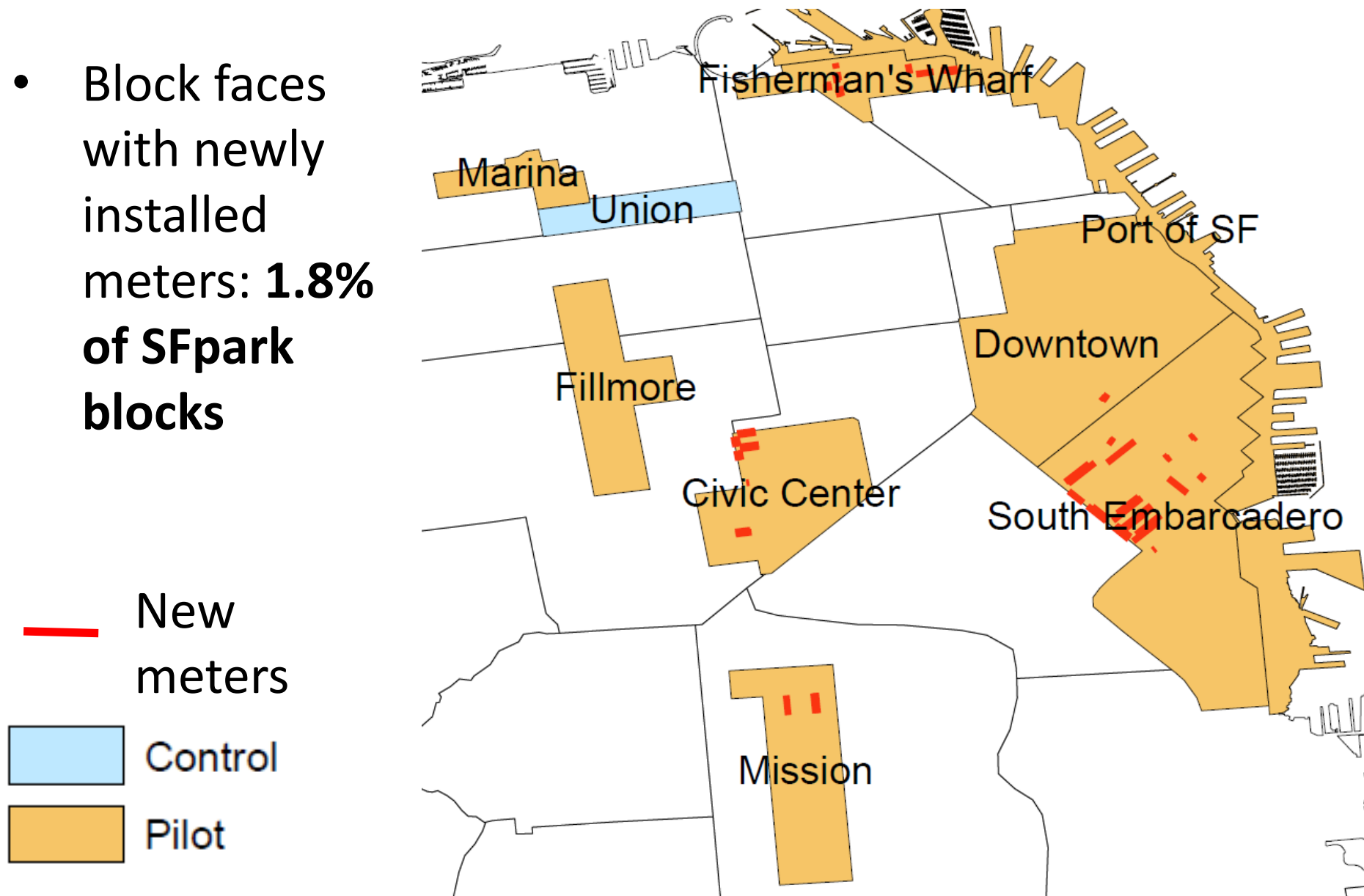


Research objectives

1. Assess the effectiveness of SFpark on achieving its target occupancy range of 60 to 80%
 - New meter installation
 2. Examine the effects on two other transportation outcomes:
 - Transit usage
 - Congestion
- Our study differs in methodology and data from previous literature
 - Regression analysis
 - Rich transit bus data

Map of SFpark pilot blocks with new meters and parking management districts

- Block faces with newly installed meters: **1.8% of SFpark blocks**



Quick preview of results

- Following SFpark
 - More likely to meet target occupancy range (60-80%) (*modest*)
 - Increased transit ridership
 - Meter rates increased → transit ridership increased (*modest*)
 - Reduced congestion (*modest*)
- Blocks with new meter installations
 - Unclear impact on parking occupancy and transit ridership
 - Increased congestion

Data

- SFMTA pricing and occupancy level at the time band and day type level (2011-2013)
- Muni transit bus data
 - Transit ridership at bus shift-stop level
 - 14.8 million observations
 - Focus on October to December (2009-2013)
- Congestion data from SFpark pilot evaluation
 - Daily level
 - Lane occupancy, vehicle count and average speed

Empirical approach

- Regression analysis
- Difference-in-differences approach (DiD)
 - Compare before and after for “treatment” (i.e., pilot blocks) and control groups
 - *Independent variable of interest*: dummy variable for post SFpark and pilot blocks

SFpark and occupancy

Impact of SFpark on occupancy

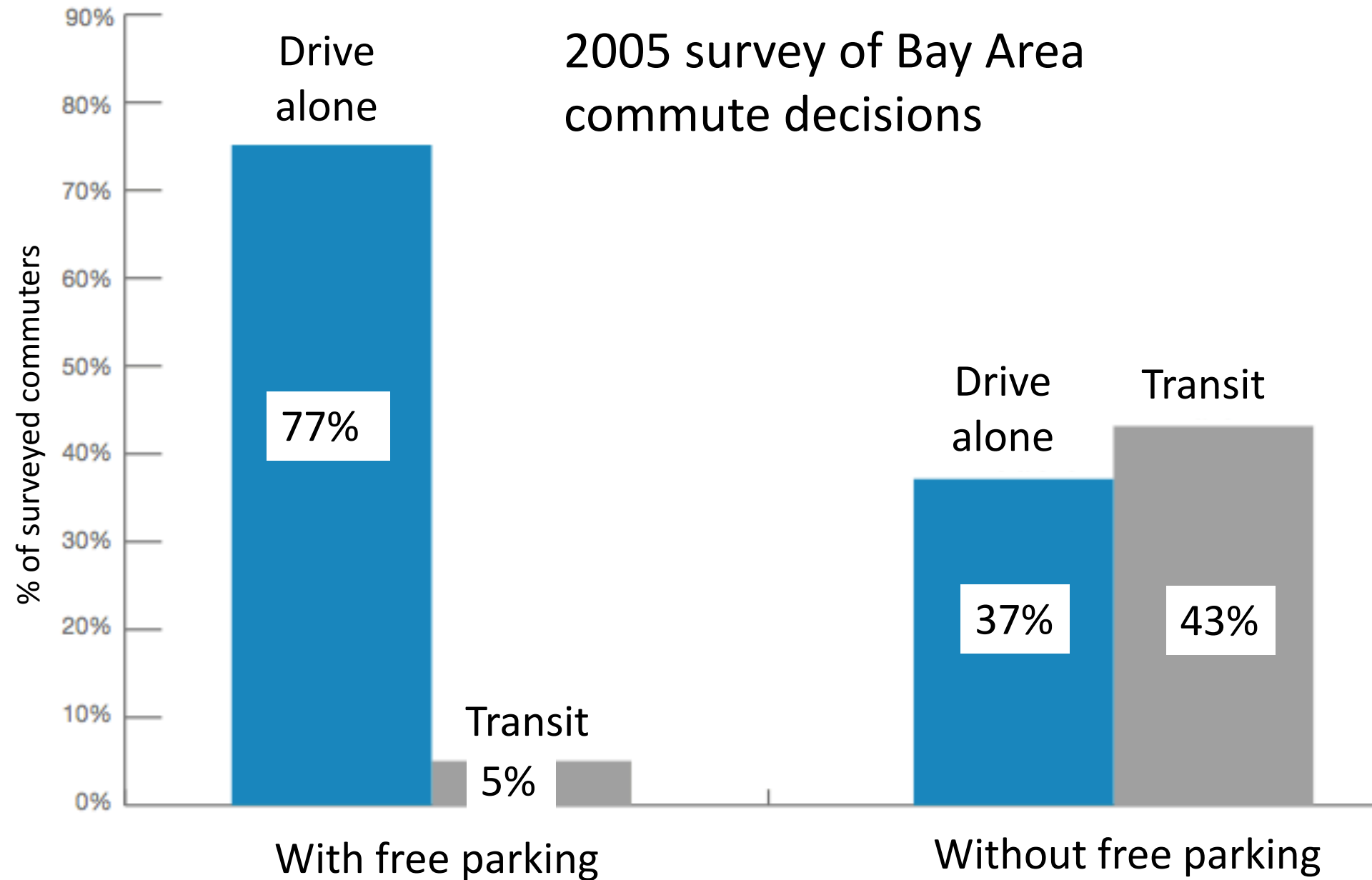
- N=2,903,086
- Reduced distance to target occupancy range on pilot blocks post-SFpark by 0.5 percentage points
 - Greater effect on weekdays and during the day
- Find *no significant effects* on blocks with new meter installations
 - Impacts unclear

SFpark and transit usage

SFpark and transit usage

- Small empirical work on effects of parking on transit usage
 - Stated-preference survey studies → suggest parking policies and rates influence mode choice
 - No study has used secondary, micro-level data
- Positive or negative relationship?
 - Positive → SFpark increases meter rates
 - Negative → SFpark increases parking availability
- Examine marginal impacts of rate changes (e.g., effects from \$1 increase in parking rates)

2005 survey of Bay Area commute decisions



Source: SFpark Pilot Overview, p. 39 (SFMTA 2014); *Commute Profile 2005, a Survey of San Francisco Bay Area Commute Patterns*. RIDES for Bay Area Commuters, Inc. August 2005.

Methods

- Difference-in-differences approach
 - *Dependent variable*: Total number of people embarking and disembarking at bus stops within 500 ft of the centroid of the census block
 - Control group: non-SFpark pilot blocks with bus stops in San Francisco prior to SFpark
- October to December 2009-2013

Map of bus stops and pilot and control blocks in San Francisco



Impact of SFpark on transit usage

- N=5,646,158
- Increase in total transit ridership during rush hour on pilot blocks post-SFpark
 - No *significant* effect from blocks with newly installed meters
- Unique opportunity to consider impacts of meter rate changes

Impact of SFpark on transit usage

- A \$1 increase in meter rates on pilot blocks post SFpark → transit bus ridership increases by 57 people
 - Average total ridership at bus stops within 500 ft of SFpark pilot blocks: 180 people
 - Average absolute value of rate changes at pilot blocks post SFpark: \$0.10
 - Transit Ridership *increases by 6 people* (or 3% of average ridership)
- People substituting transit with non-transit travel following rate change

Other tests and robustness checks

- Test robustness of relationship using different samples and models
 - SFpark pilot and control blocks (n=323,984)
 - \$0.10 increase → increase in total transit bus ridership of 6 people
 - Independent variable of interest: Number of rate adjustment periods
 - Significant, positive relationship between total transit bus ridership and rate changes

SFpark and congestion

SFpark and congestion

- Previous work relating parking to cruising
- Focus on different measures of congestion
- Use data from SFpark's pilot evaluation
 - Roadway sensors
 - Data at daily level
- Method: Difference-in-differences approach
 - Dependent variable: lane occupancy, vehicle count and average speed
- Future work

Impact on congestion

- N=59,340
- Reduced lane occupancy and small increase in average speed on weekdays
- No *significant* effect on vehicle count
- At blocks with new meters:
 - Small increase in lane occupancy and reduction in average speed
 - Puzzling result
- Major limitation: Aggregate congestion data to daily level so masking important within day variation

Takeaways and comparisons to previous literature

1. SFpark moved occupancy closer to the target occupancy range (*modest*)
 - Reinforce previous literature
 - No *significant* effect at blocks with new meters
 - SFpark Pilot eval: blocks with new meters were full 90% of the time → 15% of the time
2. SFpark associated with increases in transit ridership
 - Positive relationship with meter rate changes
 - Agrees with previous stated-preference surveys
 - Robust to different models and samples

Takeaways and comparisons to previous literature

3. SFpark associated with modest reduction in congestion
 - Similar result in SFpark pilot evaluation
 - Small increase in congestion at blocks with new meters

Future work

- Explore impacts of blocks with new meters more
 - Puzzling results
 - Sunday metered parking
- Consider different congestion measures
 - Transit bus speed between stops → larger, more detailed data
- Impacts of SFpark on air quality
 - Preliminary results suggest no significant effect
- Related work
 - Transportation modal choice (e.g., Uber movement)
 - Explore transit bus patterns (interest?)

References

- SFMTA (2014) SFpark: Putting theory into practice, Pilot project summary and lessons learned
- Millard-Ball, A., Weinberger, R. & Hampshire, R. (2013). Comment on Pierce and Shoup: Evaluating the impacts of performance-based parking. *Journal of the American Planning Association*, 79, 330-335
- Millard-Ball, A., Weinberger, R. & Hampshire, R. (2014). Is the curb 80% full or 20% empty? assessing the impacts of San Francisco's parking pricing experiment. *Transportation Research Part A*, 63, p. 76-92
- Pierce, G. & Shoup, D. (2013a). Getting the prices right. *Journal of the American Planning Association*, 79, 67-81.
- Shoup (2011). *The high cost of free parking*. APA Planners Press.

Thank you

Questions?

Monday-Friday 9am to noon



Monday-Friday Noon to 3pm



Monday-Friday 3pm to 6pm



- Increase \$0.25
- Decrease \$0.25
- No change
- Decrease \$0.50**

** No rates were lowered \$0.50 in this pilot area.