Does Mobility-On-Demand Reduce Frictions in Megacities? Evidence from Cairo

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January 2020

Preliminary and Incomplete (please do not cite or tweet)

Spatial Frictions

- Spatial Frictions have wide-ranging impacts on individual choices:
  - Which jobs to take
  - Which places to shop at
  - Where to get an education
  - Who to socialize with, etc

- Mobility-on-demand services (like Uber and Lyft) have the potential to reduce these spatial frictions and lead to welfare gains

- But identifying these welfare gains is difficult since impacts are likely diffuse
  - One obvious place to expect concentrated impacts is on mobility itself...

Estimating Impacts on Mobility is Hard

- Trip choices are endogenous and conditional on the traveler comparing a wide range of trade-offs/transit options
- Individual services can act as complements or substitutes, affecting the interpretation of effects of any specific intervention
- Individual-level data on the totality of transport choices are rarely available

Implications for Transit Policy

- Understanding mobility responses is essential for transit policy
  - Any change in one form of transport can have spillover effects on other forms of transit

- Mobility-on-Demand Services are a new and important market
  - Changing a traveler's choice set (wait-time, cost, uncertainty, safety)
  - Some cities are already partnering with MoD services to get people to public transit (last-mile)
  - Future autonomous vehicles may fundamentally change the transport option-set for travelers

What we do

We run an experiment with Uber riders in Cairo, Egypt

- Recently active Uber riders are invited to join “a study on mobility patterns”

- Riders who opt in and answered our surveys are randomized into three groups:
  - 50% off Uber trips for 3 Months
  - 25% off Uber trips for 3 Months
  - Control

Research Questions

How does decreasing the price of mobility-on-demand services affect:

1. Uber Utilization
    - How much do price changes in Uber services affect utilization of Uber?
2. Total Mobility
    - What is the impact on overall mobility? Does Uber serve as a compliment or substitute to other modes of transit?
    - Patterns of transport (origins/destinations, time of travel)

How do these impacts differ by gender?

How does this interact with perceptions of safety and harassment risk?

Contributions to a Growing Literature

- Impact of mobility on individual employment outcomes
  - Bryan et al. (2014), Phillips (2014), Franklin (2016), Abebe et al (2018)
- Economic costs of harassment
  - Borker (2017) , Kondlyis et al (ongoing), Field and Vyborny (ongoing)
- Impacts of transit policy changes:
  - Hanna et al (2017), Bento et al (2017), Kriendler (2018), Tsivanidis (2018)
- Lessons from ridesharing:
  - Chen et al (2019), Cook et al (2019), Angrist et al (2017), Hall & Krueger (2016), Cohen et al (2016), Cramer (2016)

Today's plan

- Today we'll focus on preliminary results that utilize the baseline survey, Uber utilization data and follow-up surveys to date

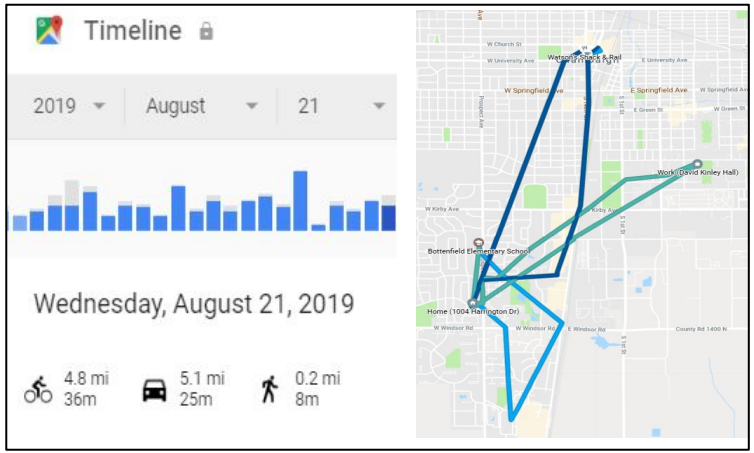
- The experiment is ongoing and we're continuing to collect data on the subjects

- Feedback on additional hypotheses to test are welcome

Data

We utilize three types of data:

1. Regular Phone Surveys
    - Demographic Characteristics
    - Labor market info
    - Counterfactual expectations about cost, time and safety across different modes of transport
2. Uber Administrative Data
    - Number of trips, time, distance, fare, etc
3. Google Maps Timeline
    - Daily distance and time traveled by mode of transport



Context: Cairo, Egypt

- Egypt is one of Uber's largest markets with millions of riders

- Cairo is a sprawling mega-city with limited public transport options
  - Central subway line that only serves a portion of the city
  - No public bus map
  - Lots of traffic

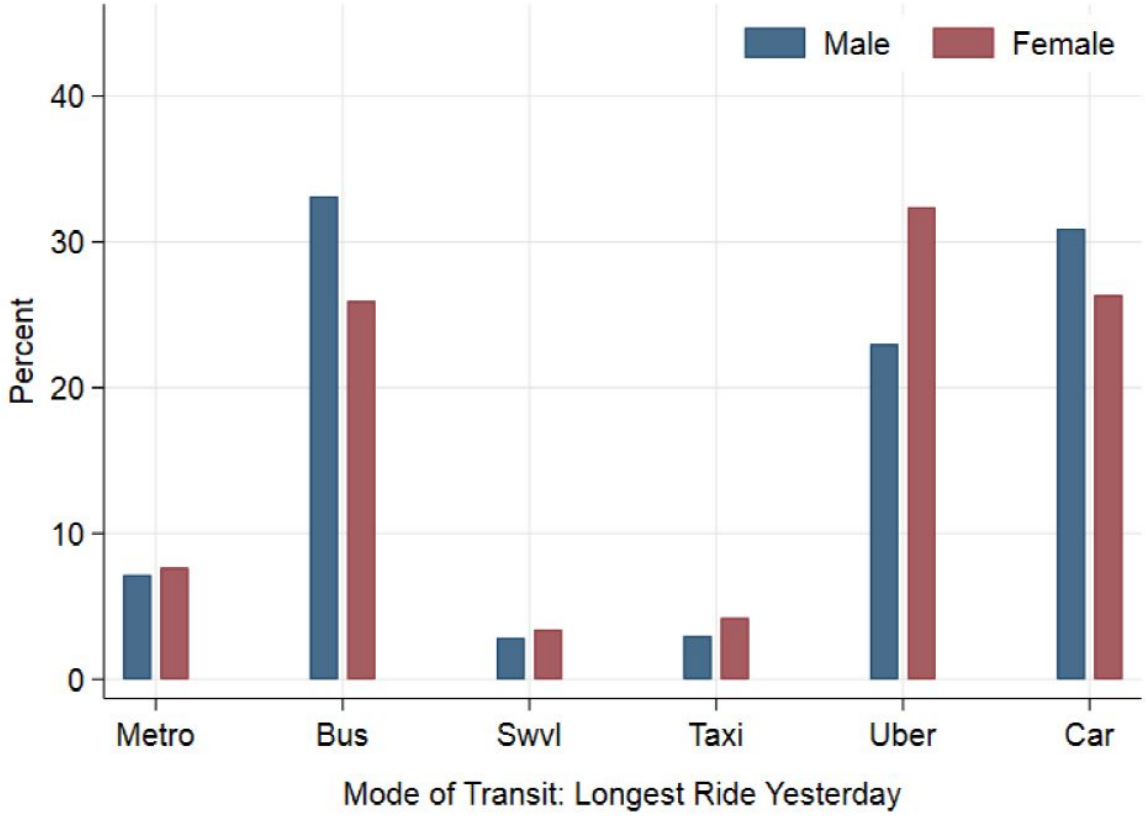
- Harassment is a persistent risk, especially for women

Sample Characteristics

Table 1: Baseline Characteristics

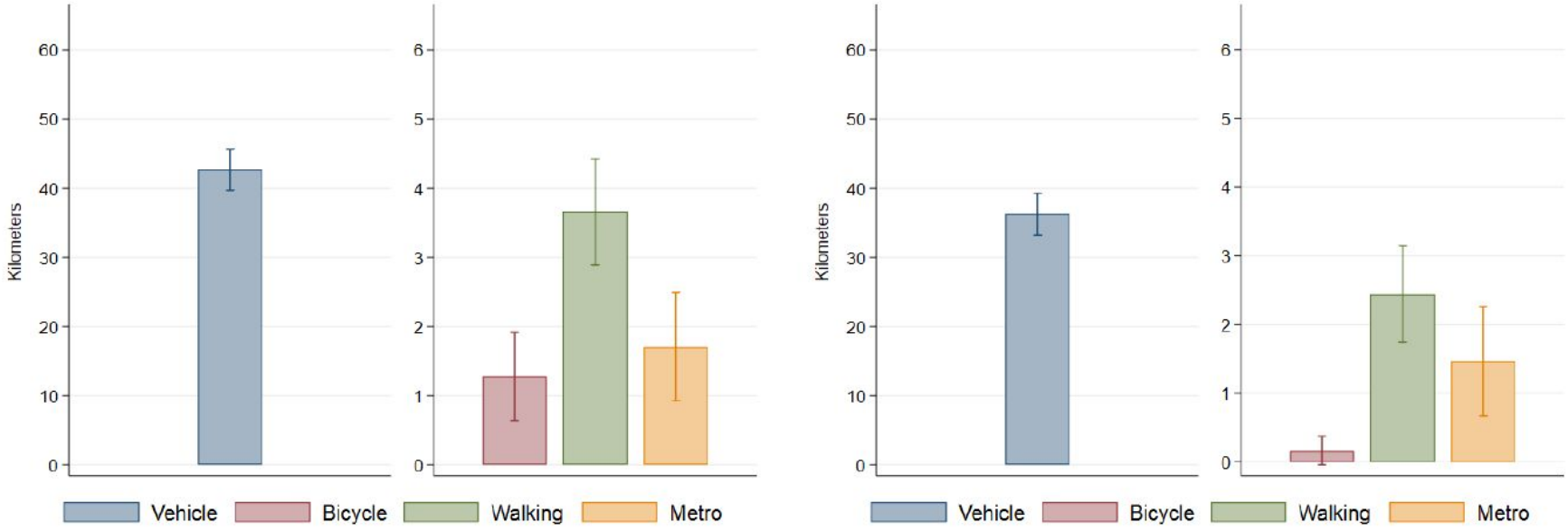
Variables	Control Mean	25% V Control	50% V Control	50% V 25%
Female	0.42	0.00	0.00	0.00
	(0.49)	(0.03)	(0.03)	(0.03)
Married	0.50	0.01	-0.05	-0.06*
	(0.50)	(0.04)	(0.03)	(0.03)
Monthly Income	4,830	-248	-551	-303
	(7,266)	(471)	(466)	(339)
Currently Working	0.79	0.02	0.01	-0.01
	(0.41)	(0.03)	(0.03)	(0.03)
Hours Worked (hours/week)	43.59	-0.43	1.29	1.72
	(11.45)	(1.05)	(1.03)	(1.14)
Looking for Work	0.50	-0.01	-0.02	-0.01
	(0.50)	(0.04)	(0.04)	(0.04)
Car Owner	0.27	0.01	-0.05	-0.06*
	(0.44)	(0.03)	(0.03)	(0.03)
Uber Trips Yesterday	0.70	0.16**	0.06	-0.10
	(0.97)	(0.08)	(0.07)	(0.08)
Total Mobility (km/week)	57.70	-4.08	4.29	8.38
	(122.08)	(7.61)	(8.88)	(7.95)
Total Time in Transit (min/week)	691.07	-100.77	-60.75	40.01
	(2,980.97)	(161.99)	(163.90)	(97.77)
Observations	405	812	816	818
Joint F-test (p-value)		0.40	0.47	0.88

Baseline Transport Behavior



Overall Mobility (Google Timeline Data)

Figure 2: Overall Mobility

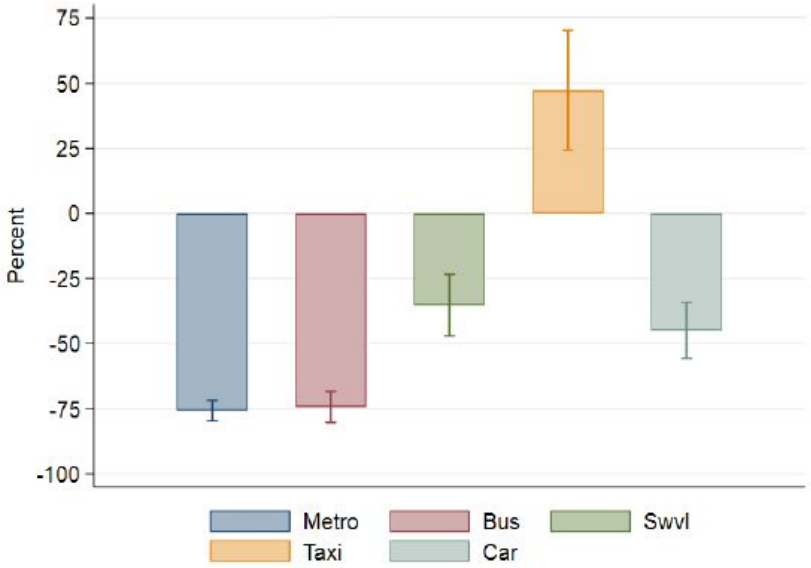


(a) Males

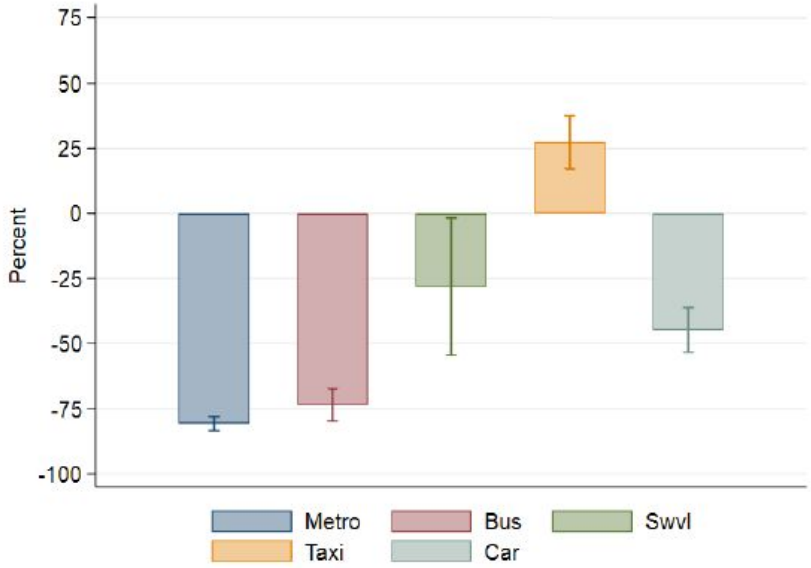
(b) Females

Expectations about Transport Modes

Figure 3: Relative Cost Compared to Uber



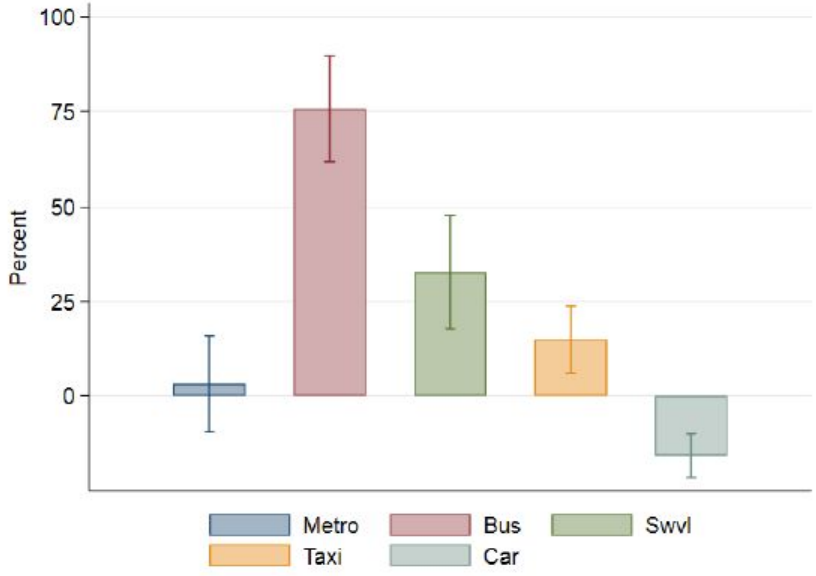
(a) Males



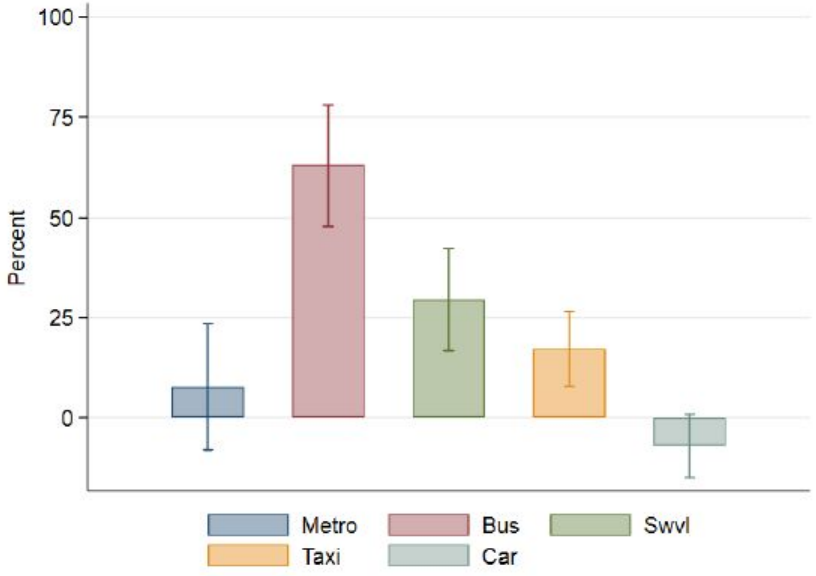
(b) Females

Expectations about Transport Modes

Figure 4: Relative Duration Compared to Uber



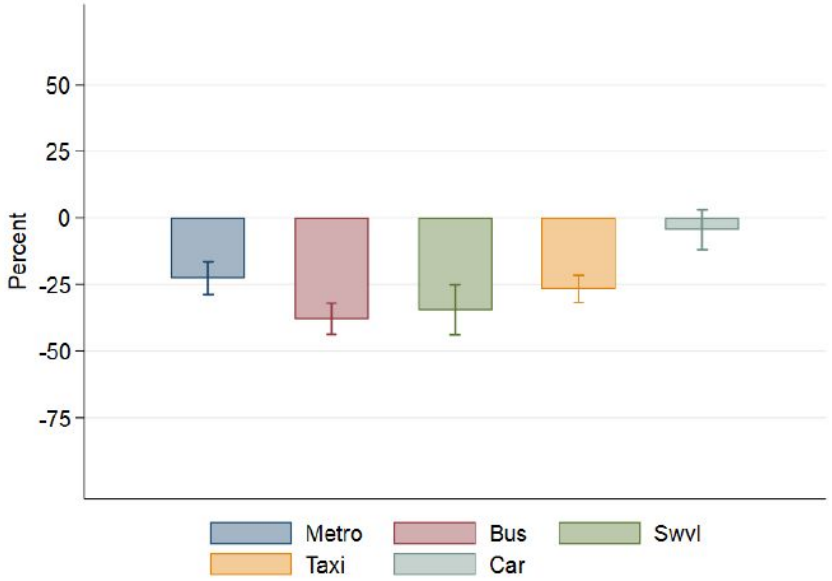
(a) Males



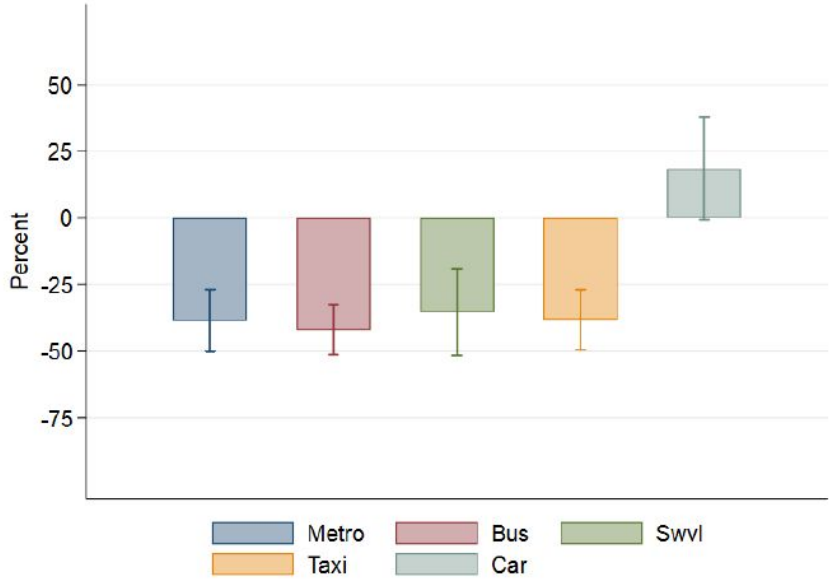
(b) Females

Expectations about Transport Modes

Figure 5: Relative Safety Compared to Uber



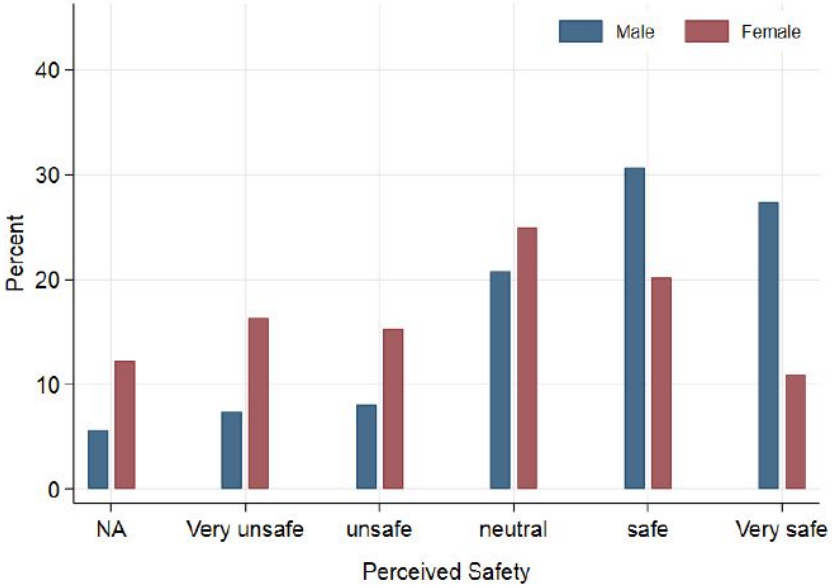
(a) Males



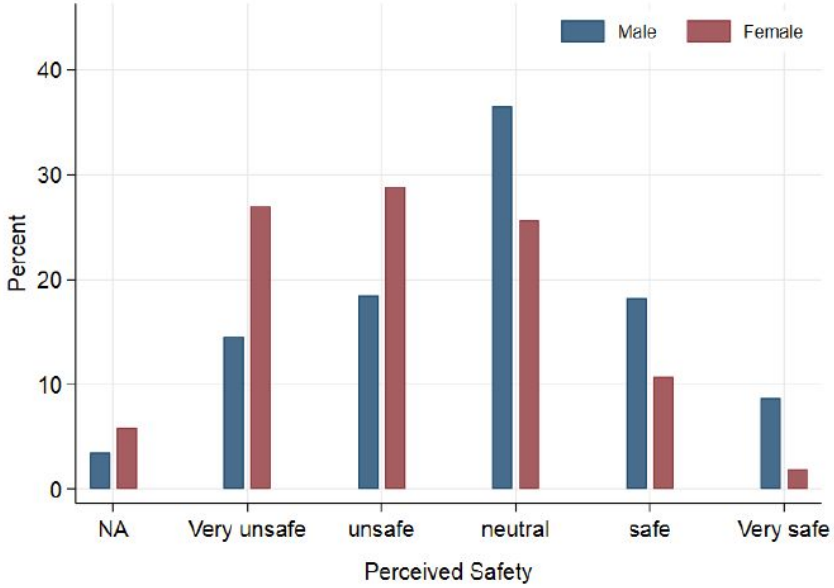
(b) Females

Expected Safety - Public Transit Modes

Figure 6: Transit Modes



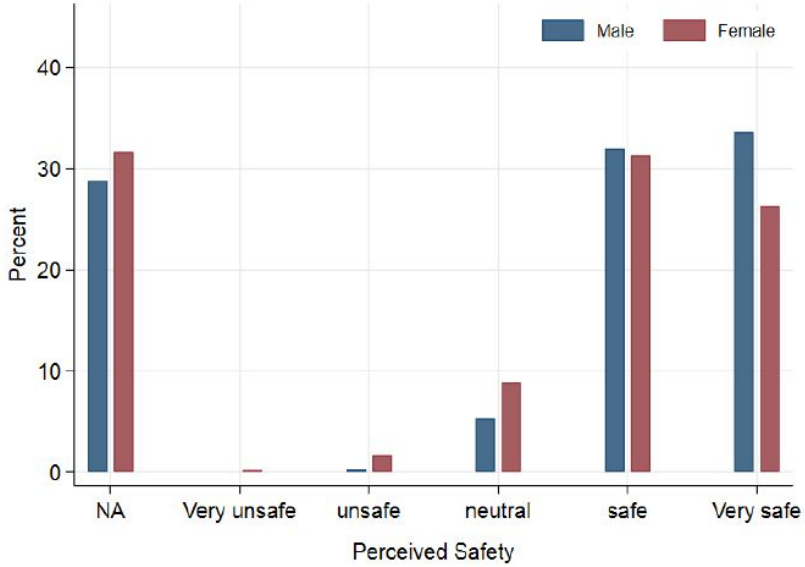
(a) Metro



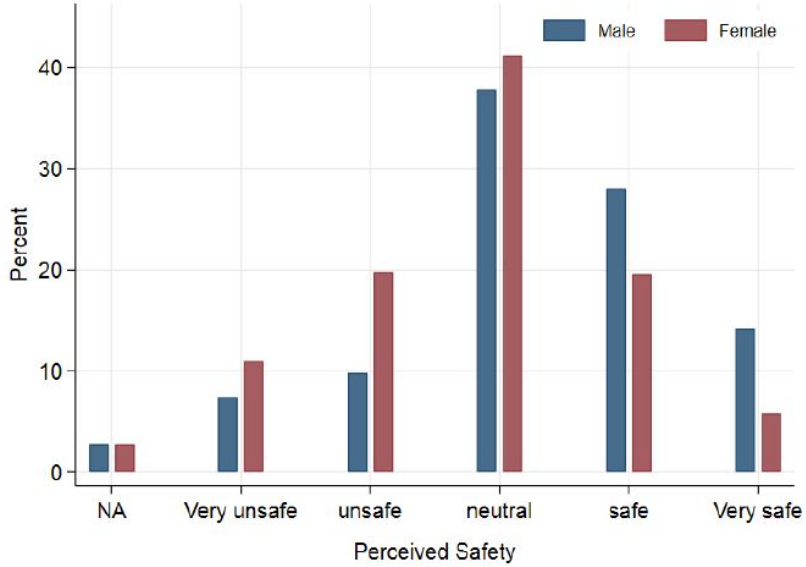
(b) Bus

Expected Safety - Private Transit Modes

Figure 7: Transit Modes



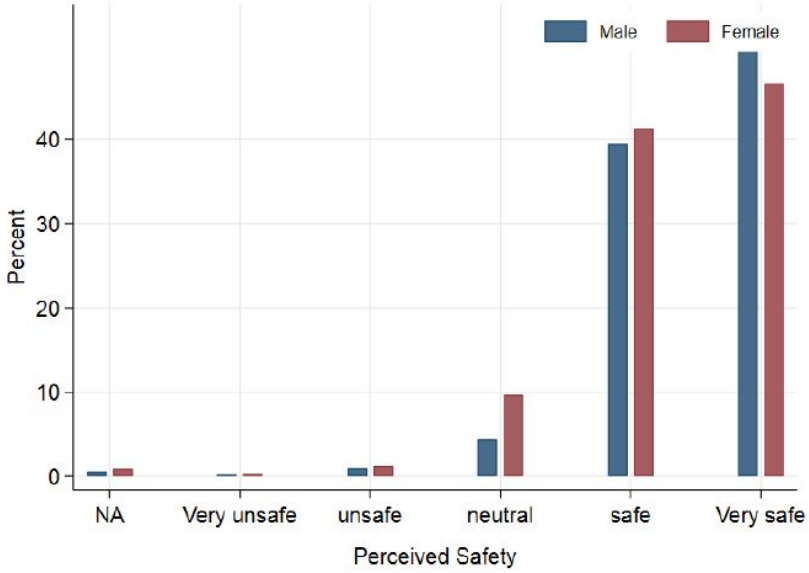
(a) SWVL



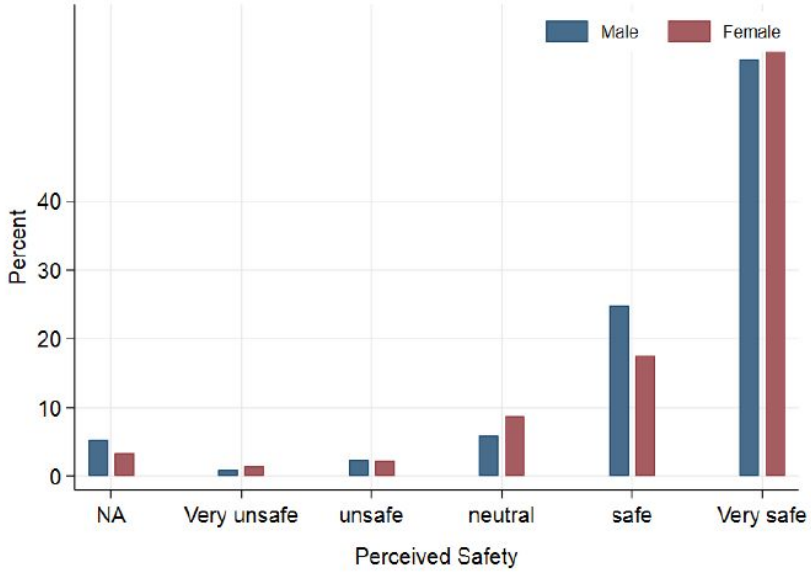
(b) Taxi

Expected Safety - Private Transit Modes

Figure 8: Transit Modes



(a) Uber

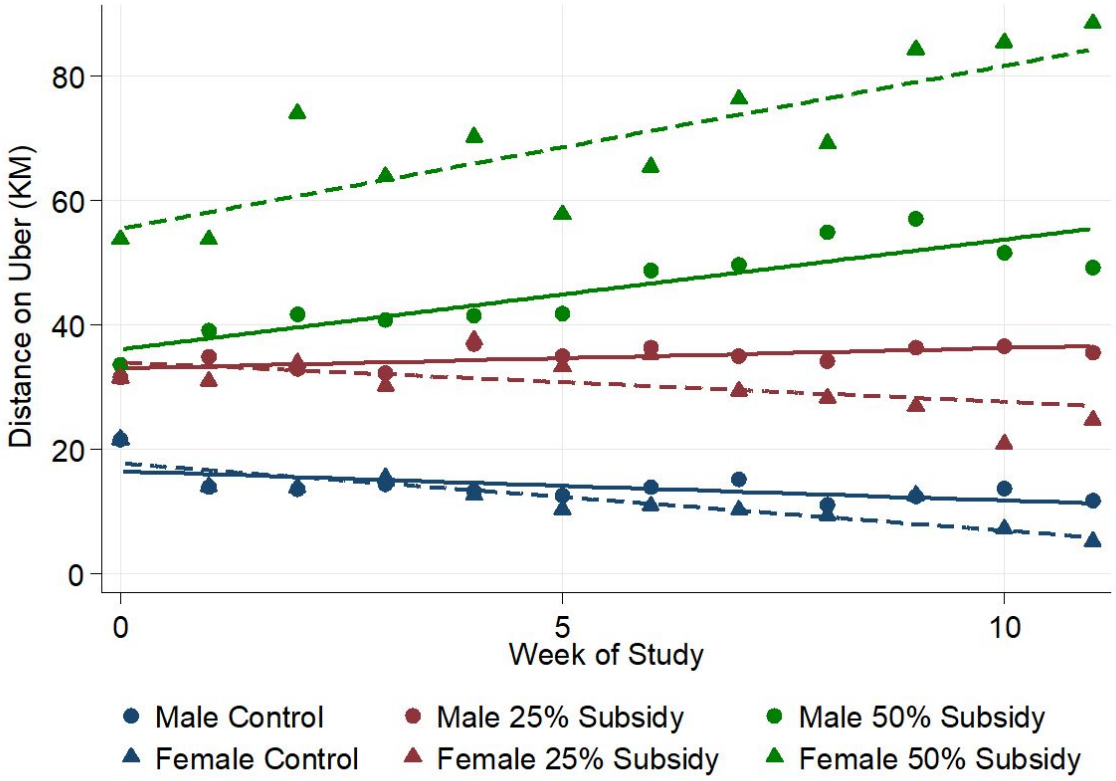


(b) Car

Impact of Uber Subsidies on Uber Usage

	Weekly KM on Uber (IHS)		Weekly Trips on Uber	
25% Subsidy	1.12 ***	1.13 ***	1.90 ***	2.04 ***
	(0.10)	(0.14)	(0.23)	(0.32)
25% Subsidy * Female		-0.05		-0.40
		(0.20)		(0.44)
50% Subsidy	1.75 ***	1.64 ***	3.67 ***	3.33 ***
	(0.11)	(0.14)	(0.27)	(0.34)
50% Subsidy * Female		0.30		0.94 *
		(0.21)		(0.56)
Obs	10959	10959	10959	10959
Control Group Mean	12.9	12.8	1.42	1.38
Control Group Mean (Female)		13.0		1.49

Uber Utilization by Week of Study



Impacts on Total Mobility are Ambiguous

To the extent that Uber is used as a substitute for other modes (ie public transit, taxi), then overall mobility may not increase

- Buses and metro lines rarely take the most direct path from a traveler's origin to their destination, whereas Uber does

Overall mobility would increase if people use Uber to go on trips that they would not otherwise take

- Uber shifts the cost of travel that wasn't worthwhile on outside options
- Uber is used as a compliment (transit-linked trips)

Different types of riders may use Uber differently, some as a substitute and others as a complement, and likely both at different times

Impacts on Total Mobility

	Total KM Past 3 Days (IHS)		Minutes Spent in Travel (IHS)	
25% Subsidy	0.213 **	0.178	-0.002	0.015
	(0.099)	(0.122)	(0.112)	(0.140)
25% Subsidy * Female		0.053		-0.069
		(0.196)		(0.227)
50% Subsidy	0.331 ***	0.319 ***	0.288 ***	0.264 **
	(0.093)	(0.118)	(0.100)	(0.128)
50% Subsidy * Female		0.063		0.079
		(0.177)		(0.201)
Obs	2292	2292	2292	2292
Control Group Mean	74.4	96.1	607	720
Control Group Mean (Female)		43.2		445

Impacts on Mode Used for Longest Trip

	Metro		Bus		Taxi		Uber		Personal Car	
25% Subsidy	-0.006	-0.002	-0.087 ***	-0.089 **	-0.020 **	-0.006	0.125 ***	0.125 ***	-0.001	-0.011
	(0.016)	(0.020)	(0.028)	(0.037)	(0.009)	(0.010)	(0.026)	(0.033)	(0.030)	(0.040)
25% Subsidy * Female		-0.008		0.003		-0.034 *		0.006		0.022
		(0.033)		(0.057)		(0.018)		(0.054)		(0.061)
50% Subsidy	-0.003	0.009	-0.099 ***	-0.078 **	-0.016 *	-0.002	0.143 ***	0.128 ***	-0.022	-0.045
	(0.015)	(0.020)	(0.028)	(0.038)	(0.009)	(0.010)	(0.026)	(0.031)	(0.029)	(0.039)
50% Subsidy * Female		-0.029		-0.049		-0.035 *		0.032		0.056
		(0.031)		(0.056)		(0.019)		(0.054)		(0.059)
Obs	2174	2174	2174	2174	2174	2174	2174	2174	2174	2174
Control Group Mean	0.070	0.065	0.336	0.353	0.031	0.022	0.187	0.149	0.328	0.358
Control Group Mean (Female)		0.078		0.311		0.042		0.240		0.286

Impacts on Reported Safety on Recent Trips

	Feeling on Longest Trip Yesterday (5=Very Safe, 1=Very Unsafe)	
25% Subsidy	0.054	-0.062
	(0.067)	(0.081)
25% Subsidy * Female		0.280 **
		(0.137)
50% Subsidy	0.075	-0.047
	(0.064)	(0.080)
50% Subsidy * Female		0.291 **
		(0.132)
Obs	2090	2090
Control Group Mean	4.09	4.12
Control Group Mean (Female)		4.07

Next Steps

- Deeper into Heterogeneity:
  - How to impacts differ for people without cars? Job seekers? etc
- How do travel patterns (origins/destinations) change?
  - Where do they travel to when mobility-on-demand is more accessible?
  - Do they change their travel patterns across time of day and/or day of week?
- Longer term questions about labor market impacts for job-seekers and potential changes in travel patterns
  - Job search intensity
  - Hours worked (per week)
  - Wages

Thanks!