

# **ONLINE APPENDIX**

## **The Value of Time in the United States**

Ariel Goldszmidt, John A. List, Robert D. Metcalfe,  
Ian Muir, V. Kerry Smith, Jenny Wang

October 12, 2020

# Contents

<b>A Derivations</b>	<b>3</b>
<b>B Additional Figures</b>	<b>5</b>
<b>C Additional Tables</b>	<b>15</b>
<b>D Lateness regressions</b>	<b>45</b>
<b>E Demand Effects After End of Experiment</b>	<b>48</b>
<b>F Time to Destination</b>	<b>51</b>
<b>G Removing always- and/or never-requesters</b>	<b>53</b>
<b>H External Validity</b>	<b>62</b>
<b>I Correcting for User Selection into Ride Contexts</b>	<b>68</b>
<b>J Reweighting Elasticity Estimates</b>	<b>79</b>
<b>K Ride Types</b>	<b>86</b>
<b>L Distribution of VOT</b>	<b>89</b>
<b>M Causality with Interaction Effects</b>	<b>91</b>

## A Derivations

**Equation (2).** The utility maximization problem is

$$\begin{aligned} & \max_{Z_1, Z_2} u(Z_1, Z_2) \\ \text{subject to} & \quad p_1 x_1 + p_2 x_2 = wT_w + R \\ & \quad x_i = a_i Z_i, i = 1, 2 \\ & \quad T_1 + T_2 + T_w = \bar{T} \\ & \quad T_i = t_i Z_i, i = 1, 2. \end{aligned}$$

By substituting the second constraint into the first and the fourth into the third, the problem may be rewritten as

$$\begin{aligned} & \max_{Z_1, Z_2} u(Z_1, Z_2) \\ \text{subject to} & \quad p_1 a_1 Z_1 + p_2 a_2 Z_2 = wT_w + R \\ & \quad t_1 Z_1 + t_2 Z_2 + T_w = \bar{T}. \end{aligned}$$

Solving for  $T_w$  from the second constraint and plugging it into the first, we have

$$\begin{aligned} & \max_{Z_1, Z_2} u(Z_1, Z_2) \\ \text{subject to} & \quad (p_1 a_1 + wt_1)Z_1 + (p_2 a_2 + wt_2)Z_2 = w\bar{T} + R. \end{aligned}$$

The utility maximization problem is now in the standard form, with the (full) prices of  $Z_1$  and  $Z_2$  given by  $p_1 a_1 + wt_1$  and  $p_2 a_2 + wt_2$  and the (full) income given by  $w\bar{T} + R$ . Hence the indirect utility function that results from solving this problem can be generically written as  $\bar{V} = \bar{V}(p_1 a_1 + wt_1, p_2 a_2 + wt_2, w\bar{T} + R)$ .

**Equation (3).** Let  $P_i = P_i(w) = p_i a_i + wt_i$  denote the (full) price of consuming one unit of  $Z_i$ , which is a function of  $w$ , and let  $M = M(w, R) = w\bar{T} + R$ . Since  $\bar{V} = \bar{V}(P_1, P_2, M)$ , the chain rule gives

$$\begin{aligned} \frac{d\bar{V}}{dw} &= \bar{V}_{P_1}(P_1)_w + \bar{V}_{P_2}(P_2)_w + \bar{V}_M M_w \\ &= \bar{V}_{P_1} t_1 + \bar{V}_{P_2} t_2 + \bar{V}_M \bar{T} \end{aligned}$$

and

$$\frac{d\bar{V}}{dR} = \bar{V}_M M_R = \bar{V}_M.$$

Dividing the first equation by  $\bar{V}_M$  on the right and by  $\frac{d\bar{V}}{dR}$  on the left, we have

$$\frac{\frac{d\bar{V}}{dw}}{\frac{d\bar{V}}{dR}} = \frac{\bar{V}_{P_1}}{\bar{V}_M} t_1 + \frac{\bar{V}_{P_2}}{\bar{V}_M} t_2 + \bar{T}.$$

Finally, we apply Roy's identity  $\frac{\bar{V}_{P_i}}{\bar{V}_M} = -Z_i^*$  to conclude

$$\frac{\frac{d\bar{V}}{dw}}{\frac{d\bar{V}}{dR}} = -Z_1^* t_1 - Z_2^* t_2 + \bar{T}.$$

**Equation (6).** Starting from the modified indirect utility function in equation (5), we use the chain rule to calculate

$$\begin{aligned} \frac{dV}{dT_1^a} &= V_1 \cdot (wt_1 + p_1 a_1(T_1^a))_{T_1^a} + V_2 \cdot (wt_2 + p_2 a_2)_{T_1^a} + V_3 \cdot (w(\bar{T} - T_1^a) + R)_{T_1^a} \\ &= V_1 p_1 a_1'(T_1^a) + V_3(-w) \end{aligned}$$

and

$$\begin{aligned} \frac{dV}{dR} &= V_1 \cdot (wt_1 + p_1 a_1(T_1^a))_R + V_2 \cdot (wt_2 + p_2 a_2)_R + V_3 \cdot (w(\bar{T} - T_1^a) + R)_R \\ &= V_3, \end{aligned}$$

where  $V_i$  denotes the partial derivative of the function  $V$  with respect to its  $i$ th argument. We now divide the left-hand side of the first equation by  $\frac{dV}{dR}$ , the first term on the right-hand side by  $\frac{dV}{dR}$ , and the second term on the right-hand side by  $V_3$  to conclude

$$\frac{\frac{dV}{dT_1^a}}{\frac{dV}{dR}} = \frac{V_1}{\frac{dV}{dR}} p_1 a_1'(T_1^a) - w.$$

**Equation (7).**  $\pi = -\frac{dV}{dT_1^a} / \frac{dV}{dR}$ , the (negative) marginal rate of substitution between waiting time and exogenous income, by definition. From equation (6), we have

$$\pi = -\frac{\frac{dV}{dT_1^a}}{\frac{dV}{dR}} = -\frac{V_1}{\frac{dV}{dR}} p_1 a_1'(T_1^a) + w.$$

Recalling that  $\frac{dV}{dR} = V_3$  (from the derivation of (6)) and  $V_1/V_3 = -Z_1^*$  (from Roy's identity), we have

$$\pi = -\frac{\frac{dV}{dT_1^a}}{\frac{dV}{dR}} = p_1 Z_1^* a_1'(T_1^a) + w.$$

## B Additional Figures

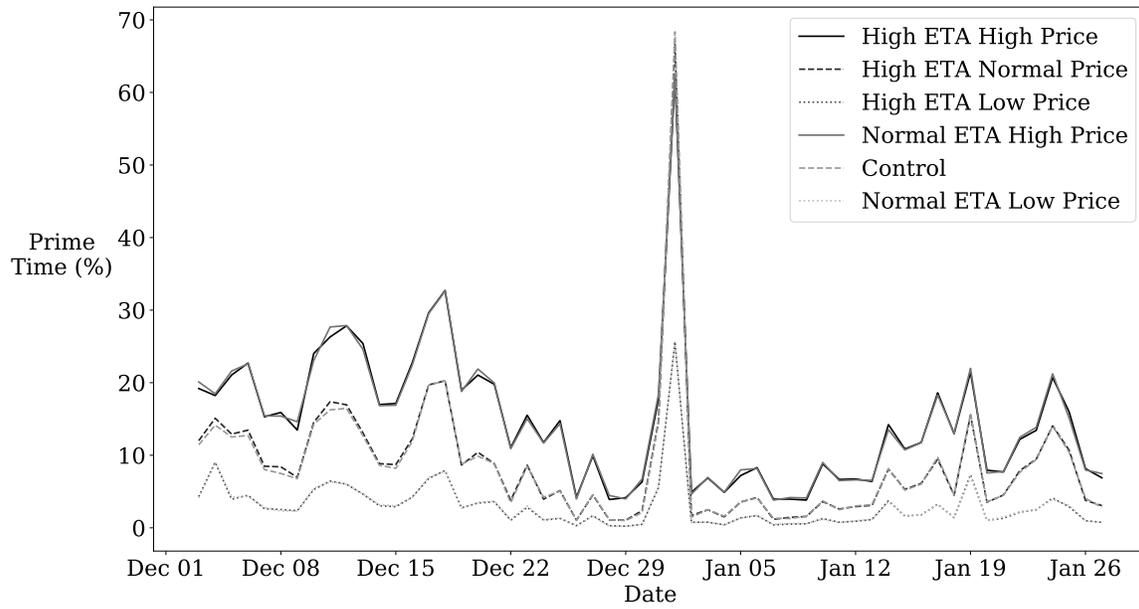
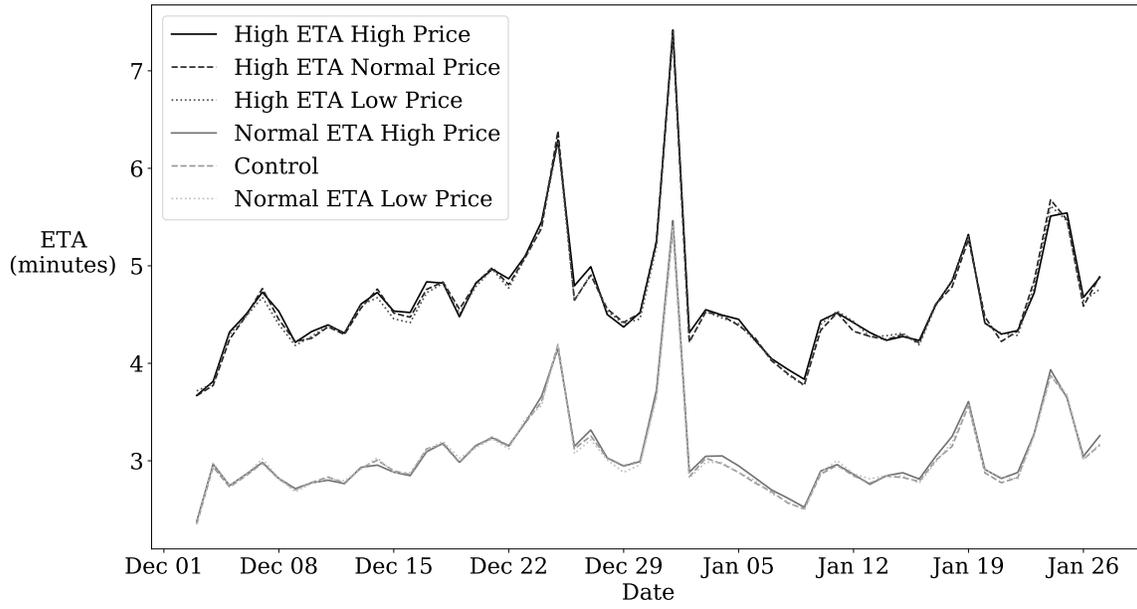
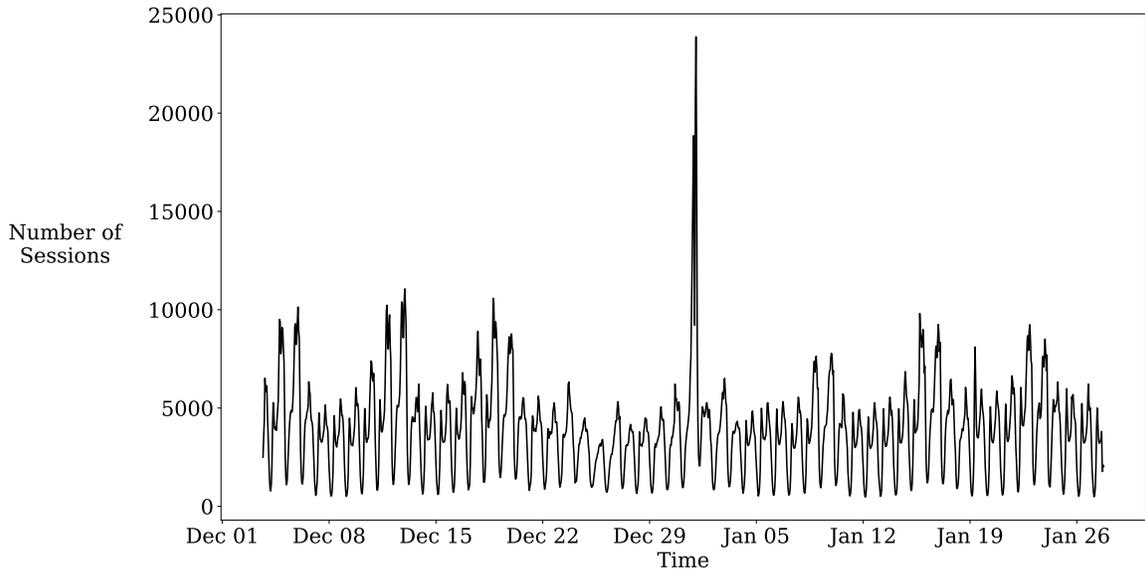


Figure B.1

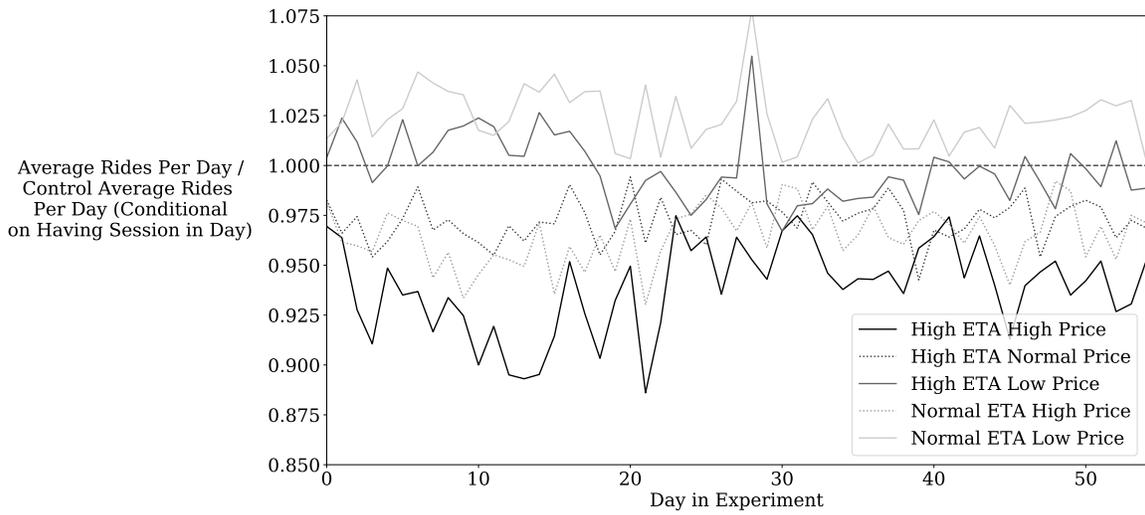
Mean Prime Time in each treatment group by each day in experiment.



**Figure B.2**  
 Mean ETA in each treatment group by each day in experiment.

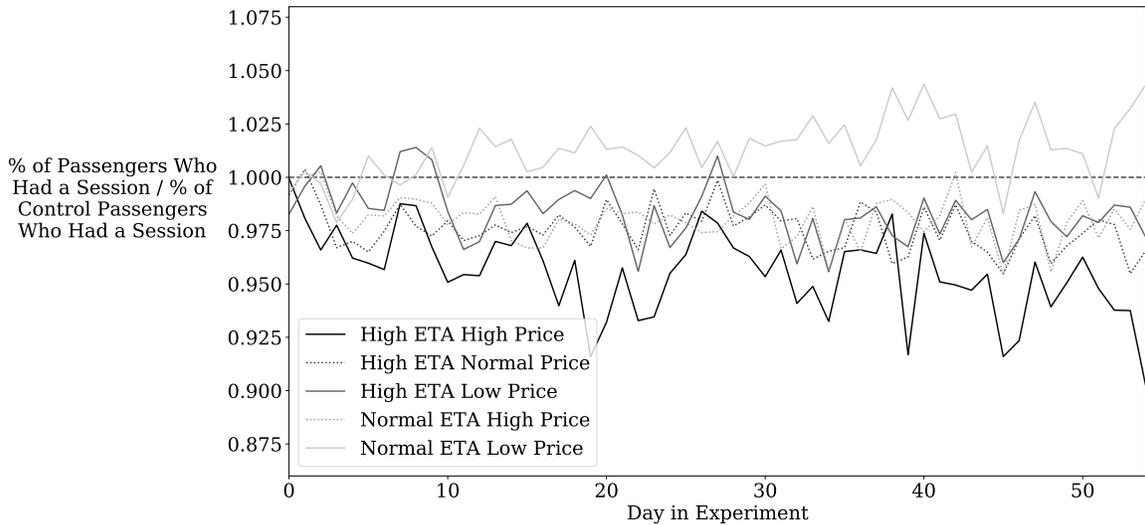


**Figure B.3**  
 Total number of sessions in each local hour of the experiment. Note the daily and weekly seasonality, and exceptional behavior near holidays. The large vertical spike is midnight of New Year's Eve.



**Figure B.4**

Each series is the average number of rides taken by a passenger in that treatment group on each day from their first session in the experiment, divided by the average number of rides taken by a control passenger.

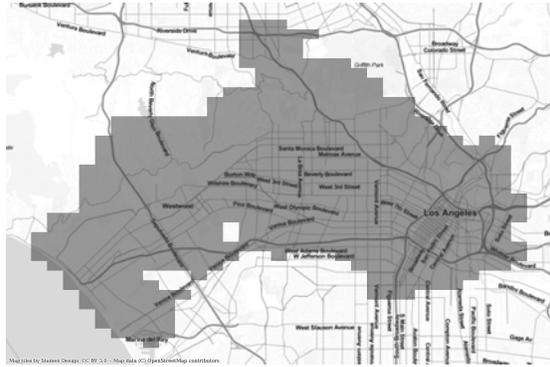


**Figure B.5**

Each series is the percent of passengers in that treatment group who had a session on that day, divided by the number of control passenger who had a session that day.



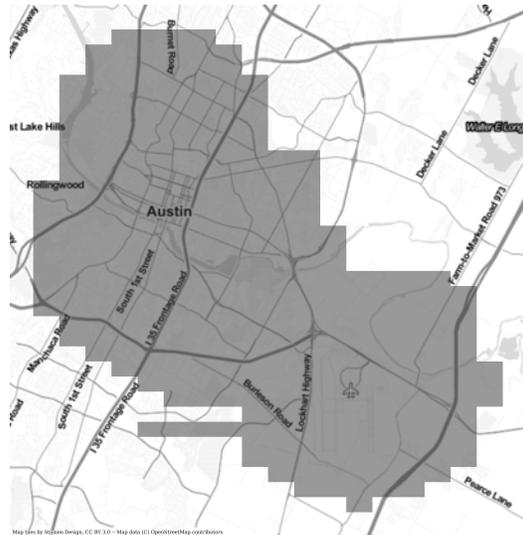
San Francisco



Los Angeles



San Diego



Austin

Figure B.6  
Areas classified as “downtown.” Maps from OpenStreetMaps.



Atlanta



Boston



Seattle

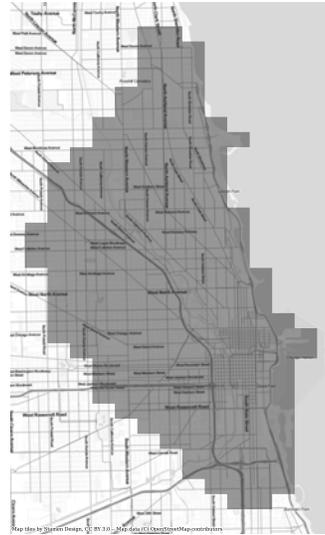


Miami

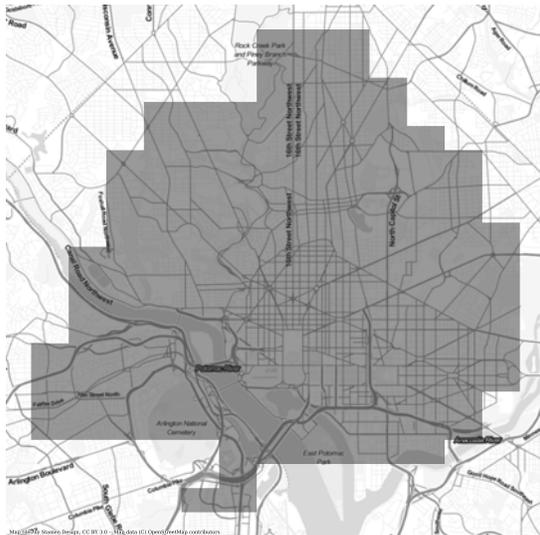
Figure B.6  
 Areas classified as “downtown.” Maps from OpenStreetMaps.



New York City



Chicago



Washington, D.C.



Philadelphia

Figure B.6  
Areas classified as “downtown.” Maps from OpenStreetMaps.



New Jersey

Figure B.6

Areas classified as “downtown.” Maps from OpenStreetMaps.

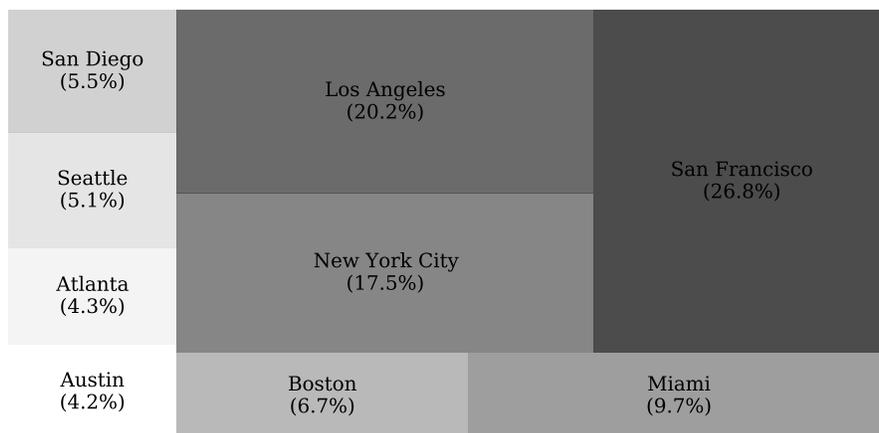
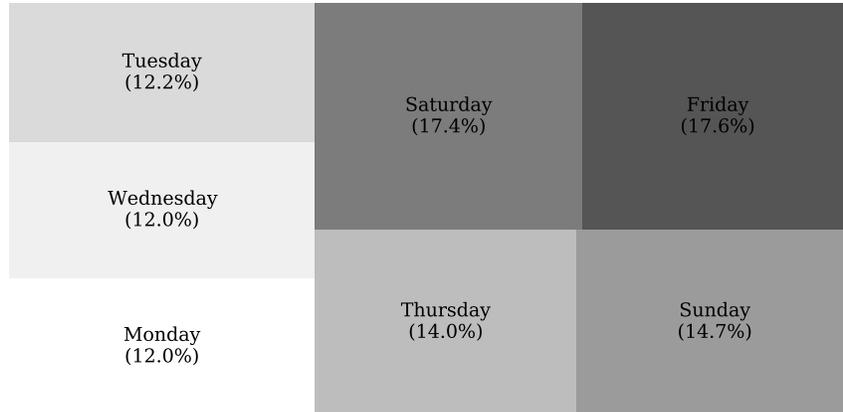
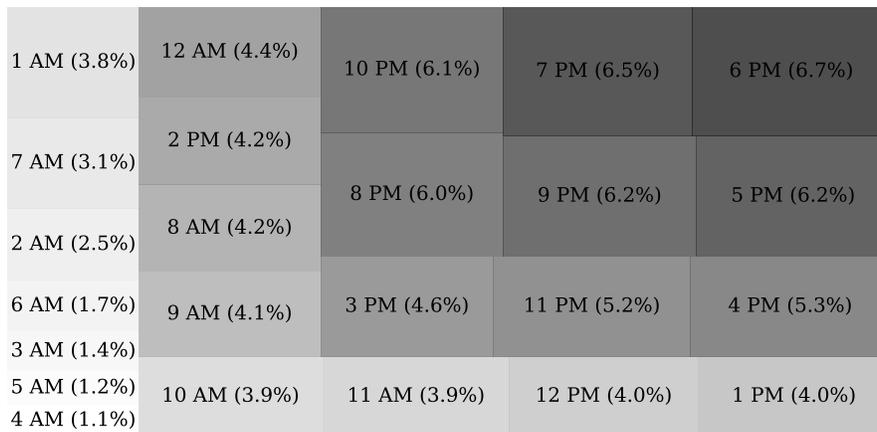


Figure B.7

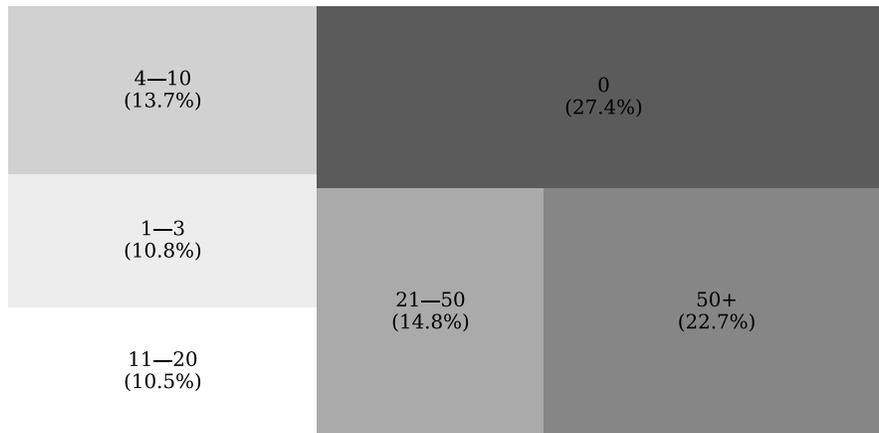
Distribution of regions across sessions. Area of each square is proportional to the number of sessions in the experiment from that region.



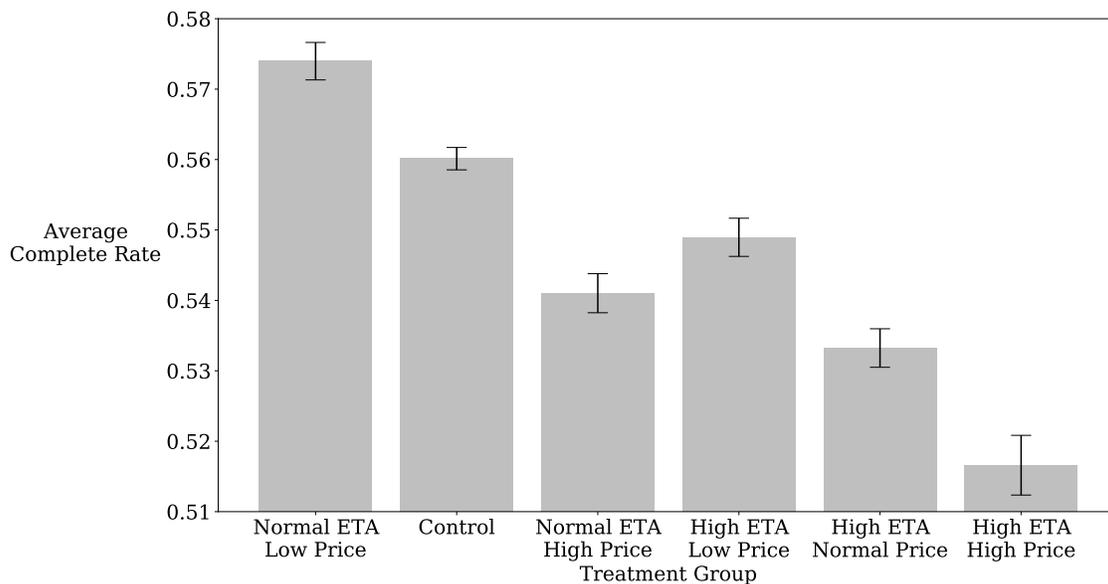
**Figure B.8**  
 Distribution of days of the week across sessions. Area of each square is proportional to the number of sessions in the experiment from that day of the week.



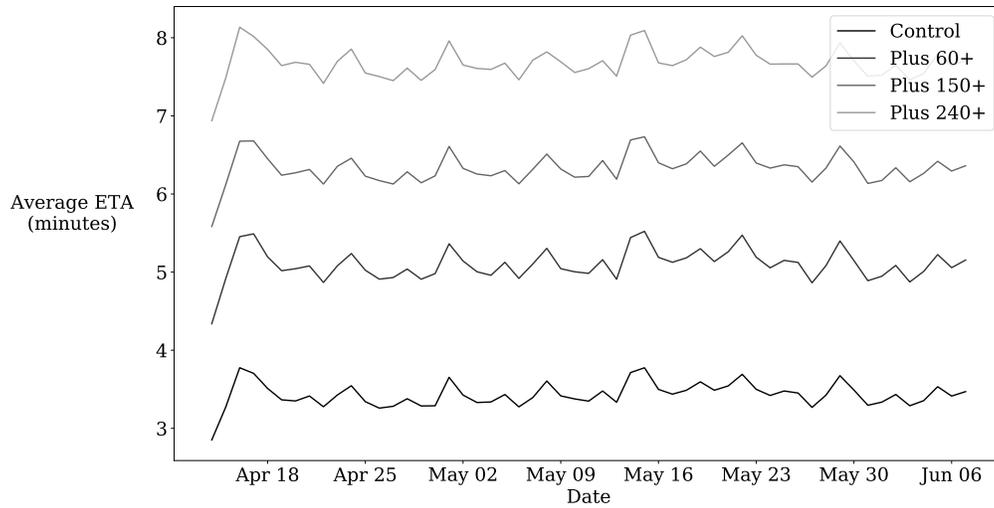
**Figure B.9**  
 Distribution of hours of the day across sessions. Area of each square is proportional to the number of sessions in the experiment from that hour of the day.



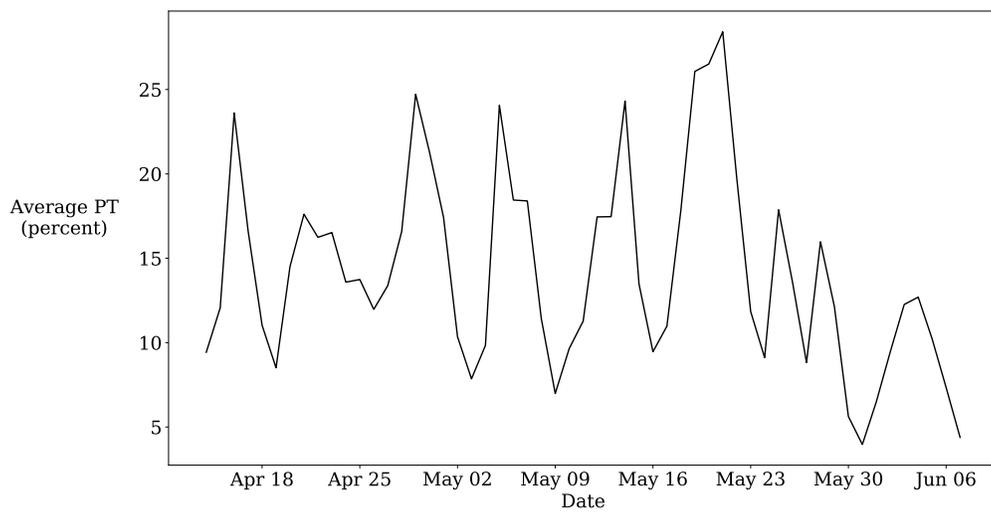
**Figure B.10**  
 Distribution of experience levels across sessions. Area of each square is proportional to the number of sessions sessions from passengers with the given number of lifetime rides, before the start of the experiment.



**Figure B.11**  
 Average completion rates across the six experimental groups. Error bars are 95% confidence intervals based on user-level clustered standard errors.



**Figure B.12**  
Timeline of ETAs across experimental treatments in experiment two.



**Figure B.13**  
Timeline of PT in experiment two.

## C Additional Tables

Table C.1

Average number of sessions, sessions with requests, and sessions with completed rides per passenger in the past 28 days and in the passenger’s lifetime, in each treatment group. Standard errors in parentheses.

	Control	High ETA High Price	High ETA Low Price	High ETA Normal Price	Normal ETA High Price	Normal ETA Low Price
# Sessions (28 days)	3.39 (0.012)	3.37 (0.033)	3.41 (0.021)	3.4 (0.021)	3.42 (0.021)	3.4 (0.021)
# Sessions (lifetime)	27.14 (0.102)	27.29 (0.28)	27.23 (0.179)	27.2 (0.179)	27.44 (0.18)	27.19 (0.179)
# Sessions w/ Request (28 days)	2.2 (0.009)	2.18 (0.025)	2.21 (0.016)	2.21 (0.016)	2.22 (0.016)	2.21 (0.016)
# Sessions w/ Request (lifetime)	17.95 (0.08)	18.01 (0.217)	17.99 (0.14)	17.95 (0.14)	18.15 (0.139)	18.0 (0.141)
# Sessions w/ Complete (28 days)	1.98 (0.008)	1.97 (0.023)	1.99 (0.015)	1.98 (0.014)	1.99 (0.015)	1.98 (0.014)
# Sessions w/ Complete (lifetime)	15.65 (0.073)	15.75 (0.198)	15.7 (0.127)	15.66 (0.127)	15.86 (0.127)	15.69 (0.129)

Table C.2

Average number of sessions, sessions with requests, and sessions with completed rides for each passenger in the experiment, by treatment group. Standard errors in parentheses.

	Control	High ETA High Price	High ETA Low Price	High ETA Normal Price	Normal ETA High Price	Normal ETA Low Price
# Passengers	292025	38674	97254	97051	97185	97870
# Sessions	7.27 (0.019)	6.87 (0.048)	7.13 (0.032)	7.04 (0.032)	7.09 (0.032)	7.38 (0.033)
# Sessions w/ request	4.51 (0.015)	4.05 (0.037)	4.44 (0.025)	4.28 (0.025)	4.26 (0.024)	4.68 (0.026)
# Sessions w/ complete	4.07 (0.014)	3.55 (0.034)	3.91 (0.023)	3.75 (0.023)	3.84 (0.023)	4.24 (0.025)

Table C.3

$p$ -values from pairwise Kolmogorov-Smirnov tests comparing the distributions of average ETA between users in different experimental treatment groups.

	Normal ETA Low Price	High ETA Low Price	Control	High ETA Normal Price	Normal ETA High Price	High ETA High Price
Normal ETA Low Price	1.0000	0.0000	0.4192	0.0000	0.0629	0.0000
High ETA Low Price	0.0000	1.0000	0.0000	0.7931	0.0000	0.9990
Control	0.4192	0.0000	1.0000	0.0000	0.2579	0.0000
High ETA Normal Price	0.0000	0.7931	0.0000	1.0000	0.0000	0.6178
Normal ETA High Price	0.0629	0.0000	0.2579	0.0000	1.0000	0.0000
High ETA High Price	0.0000	0.9990	0.0000	0.6178	0.0000	1.0000

Table C.4

$p$ -values from pairwise Kolmogorov-Smirnov tests comparing the distributions of average PT between users in different experimental treatment groups.

	Normal ETA Low Price	High ETA Low Price	Control	High ETA Normal Price	Normal ETA High Price	High ETA High Price
Normal ETA Low Price	1.0000	0.0392	0.0000	0.0000	0.0000	0.0000
High ETA Low Price	0.0392	1.0000	0.0000	0.0000	0.0000	0.0000
Control	0.0000	0.0000	1.0000	0.1199	0.0000	0.0000
High ETA Normal Price	0.0000	0.0000	0.1199	1.0000	0.0000	0.0000
Normal ETA High Price	0.0000	0.0000	0.0000	0.0000	1.0000	0.1351
High ETA High Price	0.0000	0.0000	0.0000	0.0000	0.1351	1.0000

Table C.5

Distribution of Prime Time multipliers across sessions for each experimental treatment group.

	Prime Time Level (%)								
	0%	25%	50%	75%	100%	150%	200%	250%	300%
Control	84.981	5.932	3.132	2.005	1.941	1.000	1.004	0.003	0.001
High ETA High Price	72.089	11.984	6.451	3.481	3.844	1.413	0.737	0.000	0.000
High ETA Low Price	90.755	6.108	1.743	0.708	0.644	0.026	0.018	0.000	0.000
High ETA Normal Price	84.789	6.005	3.138	2.032	2.025	1.021	0.984	0.004	0.002
Normal ETA High Price	71.984	12.031	6.416	3.497	3.914	1.412	0.746	0.000	0.000
Normal ETA Low Price	90.750	6.108	1.754	0.702	0.642	0.025	0.018	0.000	0.000

Table C.6

OLS regression results for full data sample.

	(1)	(2)
$\ln(\text{ETA})$	-0.104*** (0.001)	-0.032*** (0.001)
$\ln(1 + \text{PT})$	0.014*** (0.002)	-0.124*** (0.002)
Controls		<b>x</b>
$N$	5177358	5177358
$R^2$	0.022	0.079

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. Controls include dummy variables for local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.7  
2SLS regressions for each day of the week.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
ln(ETA)	-0.0289*** (0.0031)	-0.0285*** (0.0031)	-0.0285*** (0.0031)	-0.0251*** (0.0030)	-0.0245*** (0.0028)	-0.0249*** (0.0026)	-0.0243*** (0.0028)
ln(1 + PT)	-0.3776*** (0.0277)	-0.4208*** (0.0305)	-0.4087*** (0.0300)	-0.3557*** (0.0214)	-0.2948*** (0.0145)	-0.3763*** (0.0193)	-0.3837*** (0.0180)
ETA Elasticity	-0.0480*** (0.0052)	-0.0458*** (0.0050)	-0.0456*** (0.0050)	-0.0413*** (0.0049)	-0.0393*** (0.0045)	-0.0395*** (0.0041)	-0.0405*** (0.0046)
PT Elasticity	-0.6274*** (0.0460)	-0.6763*** (0.0490)	-0.6530*** (0.0479)	-0.5846*** (0.0352)	-0.4729*** (0.0233)	-0.5956*** (0.0306)	-0.6400*** (0.0300)
VOT	20.08*** (2.47)	17.95*** (2.22)	19.34*** (2.38)	19.44*** (2.41)	21.26*** (2.45)	18.74*** (2.04)	17.12*** (2.01)
Control Avg. ETA	3.13	3.03	2.93	3.07	3.38	2.86	3.12
Control Avg. Price	13.70	13.38	13.55	14.08	14.41	13.50	14.07
Control Req. Rate	0.606	0.627	0.630	0.610	0.625	0.634	0.604
Controls	x	x	x	x	x	x	x
$N$	621203	632247	623344	722306	913007	902130	763121
$R^2$	0.082	0.077	0.077	0.071	0.065	0.077	0.086

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.8  
2SLS regressions by time of day.

	Weekdays				
	6–10 AM	10 AM–4 PM	4–7 PM	7–11 PM	11 PM–6 AM
ln(ETA)	-0.0448*** (0.0038)	-0.0271*** (0.0033)	-0.0279*** (0.0032)	-0.0154*** (0.0029)	-0.0251*** (0.0035)
ln(1 + PT)	-0.3899*** (0.0225)	-0.4095*** (0.0353)	-0.3186*** (0.0208)	-0.3398*** (0.0255)	-0.3333*** (0.0193)
ETA Elasticity	-0.0682*** (0.0057)	-0.0466*** (0.0056)	-0.0457*** (0.0052)	-0.0244*** (0.0045)	-0.0405*** (0.0057)
PT Elasticity	-0.5936*** (0.0342)	-0.7037*** (0.0607)	-0.5224*** (0.0340)	-0.5398*** (0.0405)	-0.5386*** (0.0313)
VOT	26.71*** (2.50)	18.76*** (2.64)	22.12*** (2.70)	13.62*** (2.59)	19.03*** (2.66)
Control Avg. ETA	3.54	2.95	3.16	2.60	3.81
Control Avg. Price	13.72	13.93	13.33	13.04	16.07
Control Req. Rate	0.662	0.587	0.614	0.631	0.619
Controls	x	x	x	x	x
N	545313	859760	659754	888423	558857
R <sup>2</sup>	0.085	0.070	0.084	0.086	0.062
	Weekends				
	6–10 AM	10 AM–4 PM	4–7 PM	7–11 PM	11 PM–6 AM
ln(ETA)	-0.0307*** (0.0061)	-0.0303*** (0.0038)	-0.0285*** (0.0040)	-0.0211*** (0.0038)	-0.0159*** (0.0034)
ln(1 + PT)	-0.3791*** (0.0448)	-0.4138*** (0.0265)	-0.3664*** (0.0234)	-0.4217*** (0.0389)	-0.3412*** (0.0194)
ETA Elasticity	-0.0556*** (0.0110)	-0.0532*** (0.0066)	-0.0478*** (0.0067)	-0.0334*** (0.0061)	-0.0233*** (0.0050)
PT Elasticity	-0.6865*** (0.0811)	-0.7272*** (0.0465)	-0.6156*** (0.0393)	-0.6692*** (0.0618)	-0.4998*** (0.0285)
VOT	17.40*** (3.80)	18.92*** (2.49)	20.16*** (2.92)	15.04*** (2.87)	14.71*** (3.12)
Control Avg. ETA	4.13	3.09	3.14	2.59	2.76
Control Avg. Price	14.79	13.32	13.59	13.01	14.54
Control Req. Rate	0.557	0.574	0.600	0.633	0.683
Controls	x	x	x	x	x
N	135429	412620	280795	386487	449920
R <sup>2</sup>	0.078	0.082	0.092	0.091	0.062

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.9  
2SLS regressions by precipitation type.

	No Precipitation	Rain	Snow
ln(ETA)	-0.0256*** (0.0019)	-0.0318*** (0.0030)	-0.0516*** (0.0144)
ln(1 + PT)	-0.3676*** (0.0145)	-0.3483*** (0.0163)	-0.3551*** (0.0596)
ETA Elasticity	-0.0416*** (0.0031)	-0.0510*** (0.0048)	-0.1033*** (0.0288)
PT Elasticity	-0.5974*** (0.0236)	-0.5598*** (0.0263)	-0.7113*** (0.1195)
VOT	19.04*** (1.50)	23.10*** (2.26)	26.56*** (7.83)
Control Avg. ETA	3.04	3.29	5.31
Control Avg. Price	13.84	13.88	16.18
Control Req. Rate	0.618	0.626	0.500
Controls	x	x	x
<i>N</i>	4174595	749874	29693
<i>R</i> <sup>2</sup>	0.074	0.075	0.064

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.10  
2SLS regressions for business and non-business users.

	Non-Business	Business
ln(ETA)	-0.0265*** (0.0018)	-0.0233** (0.0098)
ln(1 + PT)	-0.3709*** (0.0135)	-0.2834*** (0.0522)
ETA Elasticity	-0.0433*** (0.0029)	-0.0327** (0.0138)
PT Elasticity	-0.6053*** (0.0221)	-0.3985*** (0.0734)
VOT	19.22*** (1.39)	24.42** (10.55)
Control Avg. ETA	3.11	2.30
Control Avg. Price	13.96	11.38
Control Req. Rate	0.616	0.714
Controls	x	x
N	4960178	217180
R <sup>2</sup>	0.071	0.096

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.11  
2SLS regressions on each region in the experiment.

	Austin	San Francisco	Los Angeles	Miami	Boston	Seattle	San Diego	Atlanta	New York City
ln(ETA)	-0.0181** (0.0078)	-0.0187*** (0.0034)	-0.0250*** (0.0039)	-0.0300*** (0.0060)	-0.0434*** (0.0062)	-0.0331*** (0.0068)	-0.0271*** (0.0067)	-0.0309*** (0.0092)	-0.0285*** (0.0045)
ln(1 + PT)	-0.4593*** (0.1040)	-0.2932*** (0.0183)	-0.3241*** (0.0441)	-0.3431*** (0.0596)	-0.3922*** (0.0421)	-0.3200*** (0.0477)	-0.4419*** (0.0928)	-0.4565*** (0.1418)	-0.4896*** (0.0238)
ETA Elasticity	-0.0280** (0.0120)	-0.0263*** (0.0047)	-0.0403*** (0.0063)	-0.0519*** (0.0103)	-0.0742*** (0.0107)	-0.0534*** (0.0109)	-0.0444*** (0.0109)	-0.0558*** (0.0166)	-0.0557*** (0.0088)
PT Elasticity	-0.7088*** (0.1605)	-0.4127*** (0.0257)	-0.5217*** (0.0711)	-0.5948*** (0.1033)	-0.6704*** (0.0721)	-0.5163*** (0.0770)	-0.7232*** (0.1520)	-0.8246*** (0.2561)	-0.9564*** (0.0465)
VOT	11.37** (4.76)	21.08*** (3.79)	19.52*** (3.91)	16.36*** (3.95)	23.37*** (3.79)	27.08*** (6.38)	14.80*** (4.34)	11.24** (4.40)	23.85*** (3.81)
Median Wage	18.17	24.90	19.02	16.30	25.37	23.65	19.80	17.94	22.13
Mean Wage	24.44	33.23	26.71	22.19	32.66	30.43	26.68	24.38	30.44
Control Avg. ETA	2.79	2.12	3.02	4.39	3.65	3.41	3.43	4.92	3.09
Control Avg. Price	13.40	11.65	12.71	13.73	12.86	14.85	13.81	13.62	21.08
Control Req. Rate	0.650	0.711	0.627	0.581	0.593	0.626	0.612	0.555	0.515
Controls	x	x	x	x	x	x	x	x	x
N	218666	1387300	1044273	501297	345974	266222	282393	222981	908252
R <sup>2</sup>	0.060	0.077	0.068	0.041	0.054	0.073	0.073	0.050	0.029

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides. Wage data are the "All Occupations" median and mean hourly wages for the metropolitan area most closely corresponding to each Lyft region, as reported in the May 2016 Occupational Employment Statistics (U.S. Bureau of Labor Statistics, 2016).

Table C.12  
VOT in airport and non-airport sessions.

	Non-Airport	Airport
ln(ETA)	-0.0266*** (0.0018)	-0.0143 (0.0092)
ln(1 + PT)	-0.3673*** (0.0132)	-0.3348*** (0.0924)
ETA Elasticity	-0.0431*** (0.0029)	-0.0236 (0.0152)
PT Elasticity	-0.5951*** (0.0214)	-0.5534*** (0.1525)
VOT	18.84*** (1.35)	27.55 (18.02)
Control Avg. ETA	3.09	2.92
Control Avg. Price	13.37	31.40
Control Req. Rate	0.620	0.606
Controls	x	x
$N$	5048270	129088
$R^2$	0.074	0.080

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1+PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.13  
VOT in downtown and non-downtown sessions.

	Non-downtown	Downtown
ln(ETA)	-0.0316*** (0.0028)	-0.0231*** (0.0021)
ln(1 + PT)	-0.4031*** (0.0304)	-0.3520*** (0.0128)
ETA Elasticity	-0.0598*** (0.0054)	-0.0344*** (0.0031)
PT Elasticity	-0.7624*** (0.0575)	-0.5241*** (0.0192)
VOT	17.88*** (1.97)	21.64*** (1.99)
Control Avg. ETA	4.36	2.28
Control Avg. Price	16.57	12.54
Control Req. Rate	0.533	0.674
Controls	x	x
$N$	1986393	3190965
$R^2$	0.049	0.059

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.14  
2SLS regressions by distance to nearest public transit stop.

	Under 50 Meters	50 to 200 Meters	200 to 800 Meters	Over 800 Meters
ln(ETA)	-0.0269*** (0.0028)	-0.0251*** (0.0022)	-0.0281*** (0.0032)	-0.0279*** (0.0066)
ln(1 + PT)	-0.3381*** (0.0174)	-0.3357*** (0.0154)	-0.4460*** (0.0274)	-0.5633*** (0.0780)
ETA Elasticity	-0.0393*** (0.0041)	-0.0395*** (0.0034)	-0.0505*** (0.0057)	-0.0575*** (0.0137)
PT Elasticity	-0.4951*** (0.0256)	-0.5283*** (0.0242)	-0.8021*** (0.0493)	-1.1624*** (0.1610)
VOT	23.81*** (2.56)	20.81*** (1.91)	16.90*** (2.03)	10.88*** (2.82)
Control Avg. ETA	2.47	2.82	3.60	5.29
Control Avg. Price	12.34	13.07	16.08	19.39
Control Req. Rate	0.686	0.638	0.560	0.487
Controls	x	x	x	x
<i>N</i>	1054335	2554328	1269849	298846
<i>R</i> <sup>2</sup>	0.062	0.071	0.058	0.059

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.15  
2SLS by passenger lifetime rides prior to the start of the experiment.

	0	1–3	4–10	11–20	20–50	Over 50
ln(ETA)	−0.0172*** (0.0031)	−0.0345*** (0.0053)	−0.0322*** (0.0048)	−0.0288*** (0.0056)	−0.0333*** (0.0046)	−0.0221*** (0.0037)
ln(1 + PT)	−0.2602*** (0.0280)	−0.4464*** (0.0370)	−0.4103*** (0.0362)	−0.4212*** (0.0391)	−0.4530*** (0.0319)	−0.3226*** (0.0235)
ETA Elasticity	−0.0320*** (0.0057)	−0.0727*** (0.0111)	−0.0591*** (0.0089)	−0.0469*** (0.0092)	−0.0488*** (0.0067)	−0.0281*** (0.0048)
PT Elasticity	−0.4844*** (0.0520)	−0.9417*** (0.0780)	−0.7527*** (0.0666)	−0.6863*** (0.0637)	−0.6648*** (0.0469)	−0.4116*** (0.0299)
VOT	17.62*** (3.39)	22.34*** (3.66)	22.23*** (3.68)	19.06*** (3.89)	20.41*** (2.96)	19.38*** (3.35)
Control Avg. ETA	3.59	3.50	3.28	3.07	2.81	2.31
Control Avg. Price	15.98	16.89	15.48	14.29	13.02	10.92
Control Req. Rate	0.539	0.479	0.551	0.617	0.687	0.787
Controls	x	x	x	x	x	x
<i>N</i>	1418383	561670	709230	545632	767179	1175264
<i>R</i> <sup>2</sup>	0.029	0.034	0.036	0.033	0.027	0.025

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.16  
2SLS by passenger rides in the 28 days prior to the start of the experiment.

	0	1–2	3–8	Over 8
ln(ETA)	−0.0260*** (0.0025)	−0.0297*** (0.0045)	−0.0281*** (0.0038)	−0.0222*** (0.0039)
ln(1 + PT)	−0.3231*** (0.0206)	−0.4043*** (0.0295)	−0.3975*** (0.0272)	−0.3869*** (0.0263)
ETA Elasticity	−0.0490*** (0.0047)	−0.0526*** (0.0079)	−0.0435*** (0.0058)	−0.0286*** (0.0050)
PT Elasticity	−0.6081*** (0.0388)	−0.7163*** (0.0523)	−0.6158*** (0.0422)	−0.4988*** (0.0340)
VOT	22.11*** (2.34)	21.25*** (3.35)	19.75*** (2.83)	15.22*** (2.71)
Control Avg. ETA	3.48	3.13	2.86	2.53
Control Avg. Price	15.94	15.10	13.34	11.18
Control Req. Rate	0.534	0.568	0.650	0.780
Controls	x	x	x	x
$N$	2133364	737501	1118059	1188434
$R^2$	0.037	0.055	0.051	0.035

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.17  
Results of Durbin-Wu-Hausman augmented regression test of exogeneity.

	Requested
ln(ETA)	−0.0264*** (0.0018)
ln(1 + PT)	−0.3665*** (0.0132)
ln(ETA) Residuals	−0.0094*** (0.0018)
ln(1 + PT) Residuals	0.2542*** (0.0133)
<b>Controls</b>	<b>x</b>
<i>N</i>	5177358
<i>F</i>	213***

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. The Durbin-Wu-Hausman augmented regression test of exogeneity regresses the independent variable on the suspected endogenous variables and the residuals from the first stage regressions of the suspected endogenous variables on the exogenous instruments.

*t*-tests suggest that the coefficients on the residuals in this regression differ significantly from 0, and the *F* statistic for the joint hypothesis that both coefficients are 0 is 213 ( $p < 0.0001$ ). This result supports the conclusion that ln(ETA) and ln(1+PT) are endogeneous in equation (13), so that their coefficients cannot be consistently estimated by OLS.

Controls include dummy variables for local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.18  
Test of overidentifying restrictions.

	2SLS Residuals
High ETA High Price	-0.0019 (0.0018)
High ETA Low Price	0.0001 (0.0013)
High ETA Normal Price	-0.0009 (0.0012)
Normal ETA High Price	-0.0014 (0.0013)
Normal ETA Low Price	-0.0018 (0.0012)
Controls	x
Hansen $J$	3.769

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. Independent variables are indicators for each treatment group.

The Hansen  $J$  statistic is the GMM criterion function evaluated at  $\hat{\beta}_{2SLS}$ , using a cluster-robust optimal weighting matrix. The statistic tests the null that the excluded instruments are orthogonal to the second-stage error terms, as required for 2SLS consistency. It follows an asymptotic  $\chi^2(df = 5 - 2)$  distributions in our setup, and is robust to clustering of the second stage errors.

Table C.19  
Values of time by week in experiment 1.

	1	2	3	4	5	6	7	8
ln(ETA)	-0.0212*** (0.0033)	-0.0278*** (0.0029)	-0.0283*** (0.0031)	-0.0243*** (0.0037)	-0.0195*** (0.0034)	-0.0245*** (0.0034)	-0.0269*** (0.0032)	-0.0331*** (0.0033)
ln(1 + PT)	-0.3360*** (0.0207)	-0.3534*** (0.0151)	-0.3433*** (0.0167)	-0.4000*** (0.0445)	-0.2738*** (0.0221)	-0.5261*** (0.0568)	-0.3935*** (0.0272)	-0.4213*** (0.0272)
ETA Elasticity	-0.0337*** (0.0052)	-0.0447*** (0.0047)	-0.0466*** (0.0050)	-0.0423*** (0.0065)	-0.0329*** (0.0058)	-0.0386*** (0.0054)	-0.0425*** (0.0050)	-0.0522*** (0.0052)
PT Elasticity	-0.5348*** (0.0329)	-0.5683*** (0.0243)	-0.5657*** (0.0275)	-0.6953*** (0.0773)	-0.4634*** (0.0374)	-0.8272*** (0.0893)	-0.6216*** (0.0430)	-0.6629*** (0.0429)
VOT	18.73*** (2.96)	22.93*** (2.46)	22.83*** (2.56)	16.92*** (3.04)	18.07*** (3.20)	13.37*** (2.20)	17.40*** (2.21)	18.07*** (1.97)
Control Avg. ETA	2.81	2.88	3.17	3.26	3.60	2.73	2.99	3.24
Control Avg. Price	13.93	14.00	14.64	15.12	15.25	13.04	12.69	12.41
Control Req. Rate	0.630	0.625	0.611	0.580	0.591	0.640	0.637	0.639
Controls	x	x	x	x	x	x	x	x
$N$	667477	737270	709946	496447	677050	596913	693419	598836
$R^2$	0.083	0.080	0.081	0.076	0.075	0.084	0.070	0.082

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.20  
Values of time by session in experiment one.

	1	2	3	4	5	6	7	8
ln(ETA)	-0.0250*** (0.0026)	-0.0224*** (0.0030)	-0.0255*** (0.0033)	-0.0254*** (0.0036)	-0.0285*** (0.0039)	-0.0234*** (0.0041)	-0.0255*** (0.0044)	-0.0290*** (0.0047)
ln(1 + PT)	-0.3366*** (0.0177)	-0.2817*** (0.0205)	-0.3095*** (0.0228)	-0.3326*** (0.0253)	-0.3181*** (0.0276)	-0.3031*** (0.0298)	-0.2688*** (0.0319)	-0.3364*** (0.0342)
ETA Elasticity	-0.0424*** (0.0045)	-0.0407*** (0.0055)	-0.0448*** (0.0057)	-0.0438*** (0.0062)	-0.0482*** (0.0065)	-0.0393*** (0.0069)	-0.0425*** (0.0074)	-0.0481*** (0.0079)
PT Elasticity	-0.5717*** (0.0302)	-0.5121*** (0.0373)	-0.5446*** (0.0401)	-0.5740*** (0.0437)	-0.5385*** (0.0467)	-0.5088*** (0.0501)	-0.4485*** (0.0532)	-0.5584*** (0.0567)
VOT	22.72*** (2.50)	22.81*** (3.21)	23.09*** (3.18)	21.16*** (3.14)	24.62*** (3.65)	20.88*** (3.90)	25.54*** (4.97)	23.03*** (4.09)
Control Avg. ETA	3.36	3.24	3.20	3.16	3.13	3.11	3.09	3.07
Control Avg. Price	17.14	15.51	14.96	14.62	14.31	14.03	13.88	13.69
Control Req. Rate	0.592	0.553	0.572	0.582	0.594	0.599	0.603	0.605
Controls	x	x	x	x	x	x	x	x
$N$	720059	548960	441707	367616	312175	268928	233632	203882
$R^2$	0.070	0.066	0.064	0.063	0.067	0.069	0.073	0.076

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.21  
Values of time by session in experiment one (passengers with at least three prior rides).

	1	2	3	4	5	6	7	8
ln(ETA)	-0.0322*** (0.0038)	-0.0308*** (0.0041)	-0.0306*** (0.0043)	-0.0286*** (0.0046)	-0.0340*** (0.0049)	-0.0305*** (0.0052)	-0.0289*** (0.0054)	-0.0253*** (0.0057)
ln(1 + PT)	-0.3986*** (0.0228)	-0.3194*** (0.0248)	-0.3089*** (0.0266)	-0.3528*** (0.0283)	-0.3491*** (0.0302)	-0.3467*** (0.0329)	-0.3218*** (0.0341)	-0.3352*** (0.0365)
ETA Elasticity	-0.0535*** (0.0064)	-0.0510*** (0.0068)	-0.0494*** (0.0070)	-0.0456*** (0.0074)	-0.0534*** (0.0076)	-0.0471*** (0.0080)	-0.0444*** (0.0083)	-0.0384*** (0.0087)
PT Elasticity	-0.6626*** (0.0379)	-0.5280*** (0.0411)	-0.4993*** (0.0430)	-0.5618*** (0.0451)	-0.5475*** (0.0474)	-0.5356*** (0.0508)	-0.4937*** (0.0524)	-0.5090*** (0.0554)
VOT	24.09*** (3.00)	28.52*** (4.05)	28.98*** (4.43)	23.60*** (3.96)	28.09*** (4.35)	24.88*** (4.43)	25.40*** (5.06)	21.24*** (4.95)
Control Avg. ETA	3.00	2.92	2.91	2.90	2.87	2.87	2.83	2.81
Control Avg. Price	14.92	14.40	14.22	14.05	13.80	13.53	13.35	13.22
Control Req. Rate	0.606	0.609	0.624	0.632	0.642	0.653	0.657	0.661
Controls	x	x	x	x	x	x	x	x
$N$	337881	282903	243117	212205	187175	166323	148726	133426
$R^2$	0.080	0.069	0.067	0.065	0.068	0.066	0.070	0.070

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

**Table C.22**  
Checks of robustness to data subsample.

	No Holidays	Standard Only	Considered Shared
ln(ETA)	-0.0266*** (0.0018)	-0.0336*** (0.0021)	-0.0137*** (0.0029)
ln(1 + PT)	-0.3781*** (0.0140)	-0.4182*** (0.0181)	-0.2982*** (0.0169)
<b>ETA Elasticity</b>	-0.0428*** (0.0029)	-0.0548*** (0.0034)	-0.0217*** (0.0046)
<b>PT Elasticity</b>	-0.6079*** (0.0226)	-0.6830*** (0.0296)	-0.4727*** (0.0268)
<b>VOT</b>	19.34*** (1.41)	21.44*** (1.49)	12.97*** (2.73)
<b>Control Avg. ETA</b>	<b>2.97</b>	<b>3.23</b>	<b>2.62</b>
<b>Control Avg. Price</b>	<b>13.58</b>	<b>14.36</b>	<b>12.34</b>
<b>Control Req. Rate</b>	<b>0.625</b>	<b>0.616</b>	<b>0.633</b>
<b>Controls</b>	<b>x</b>	<b>x</b>	<b>x</b>
<i>N</i>	4750614	3232416	1804771
<i>R</i> <sup>2</sup>	0.076	0.068	0.089

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.23  
Checks of robustness to model specification.

	Completed	Avg ETA	Linear ETA	Squared ETA
ln(ETA)	-0.0580*** (0.0018)	-0.0272*** (0.0018)	—	—
ln(1 + PT)	-0.3690*** (0.0131)	-0.3664*** (0.0132)	-0.3664*** (0.0131)	-0.3661*** (0.0131)
ETA	—	—	-0.4770*** (0.0321)	—
ETA <sup>2</sup>	—	—	—	-2.915*** (0.196)
VOT	42.31*** (1.83)	19.90*** (1.42)	18.01*** (1.29)	11.32*** (0.81)
Controls	x	x	x	x
N	5177358	5177358	5177358	5177358
R <sup>2</sup>	0.092	0.072	0.072	0.070

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include dummy variables for user geohash5, local hour of week and week of year, decile of user lifetime rides, an indicator of whether the user is a business user, and an indicator of whether the session is at an airport

In column (1), the dependent variable is an indicator of whether a session had a completed ride, while for the other three the dependent variable is an indicator of whether a session had a ride request. In column (2), the session-average ETA is used in place of the last-in-session ETA. In columns (3) and (4), ETA enters the equation linearly and squared, respectively, rather in logarithm. For both of these columns, ETA is in units of hours.

Table C.24  
Checks of robustness to estimation strategy.

IV-Probit (MLE)	
ln(ETA)	-0.061*** (0.006)
ln(1 + PT)	-0.934*** (0.042)
AME of ln(ETA)	-0.023*** (0.002)
AME of ln(1 + PT)	-0.351*** (0.015)
VOT	17.53*** (1.78)
<b>Controls</b>	
<i>N</i>	5177358
Log Pseudolikelihood	-7060668.5

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour.

Table C.25  
2SLS results by region, using linear functional form (experiment 1).

	Austin	San Francisco	Los Angeles	Miami	Boston	Seattle	San Diego	Atlanta	New York City
ETA	-0.350** (0.150)	-0.469*** (0.084)	-0.476*** (0.075)	-0.390*** (0.078)	-0.637*** (0.092)	-0.545*** (0.112)	-0.424*** (0.104)	-0.348*** (0.103)	-0.525*** (0.083)
ln(1 + PT)	-0.460*** (0.104)	-0.293*** (0.018)	-0.324*** (0.044)	-0.343*** (0.060)	-0.392*** (0.042)	-0.322*** (0.048)	-0.442*** (0.093)	-0.457*** (0.142)	-0.489*** (0.024)
VOT	10.18** (4.27)	18.65*** (3.35)	18.68*** (3.75)	15.61*** (3.77)	20.89*** (3.39)	25.18*** (5.90)	13.23*** (3.87)	10.38** (4.05)	22.60*** (3.61)
Control Avg. ETA	2.79	2.12	3.02	4.39	3.65	3.41	3.43	4.92	3.09
Control Avg. Price	13.40	11.65	12.71	13.73	12.86	14.85	13.81	13.62	21.08
Control Req. Rate	0.650	0.711	0.627	0.581	0.593	0.626	0.612	0.555	0.515
Controls	x	x	x	x	x	x	x	x	x
<i>N</i>	218666	1387300	1044273	501297	345974	266222	282393	222981	908252
<i>R</i> <sup>2</sup>	0.059	0.077	0.067	0.041	0.054	0.073	0.073	0.050	0.029

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.26  
Summary statistics for sessions with and without destinations entered.

	Without Destination	With Destination
Mean ETA (minutes)	3.722 (0.004)	3.364 (0.004)
Mean PT (%)	8.143 (0.022)	11.472 (0.33)
Requested	0.510 (0.001)	0.782 (0.001)

Table C.27  
2SLS results by whether session had a destination entered.

	Without Destination	With Destination
$\ln(\text{ETA})$	-0.0367*** (0.0024)	-0.0105*** (0.0022)
$\ln(1 + \text{PT})$	-0.4554*** (0.0201)	-0.3644*** (0.0137)
$\ln(\text{Price})$	—	-0.1043*** (0.0014)
<b>ETA Elasticity</b>	-0.0721*** (0.0046)	-0.0134*** (0.0028)
<b>PT Elasticity</b>	-0.8938*** (0.0394)	-0.4661*** (0.0175)
<b>VOT</b>	21.07*** (1.53)	8.20*** (1.68)
<b>Control Avg. ETA</b>	<b>3.20</b>	<b>2.90</b>
<b>Control Avg. Price</b>	<b>13.93</b>	<b>13.73</b>
<b>Control Req. Rate</b>	<b>0.514</b>	<b>0.639</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
$N$	<b>3136534</b>	<b>2040824</b>
$R^2$	<b>0.112</b>	<b>0.055</b>

*Notes:* \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  and  $\ln(1 + \text{PT})$  instrumented by experimental group indicators. Price is midpoint of estimated fare range. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment life-time rides.

Table C.28  
Effect of treatments on probability of entering destination.

Whether Destination Entered	
High ETA High Price	0.010*** (0.002)
High ETA Normal Price	-0.000 (0.002)
High ETA Low Price	-0.005*** (0.002)
Normal ETA High Price	0.010*** (0.002)
Normal ETA Low Price	-0.005*** (0.002)
Controls	x
$N$	5177358
$R^2$	0.103
$F$	21***

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $F$  test is of the null that all the coefficients on the instruments equal 0. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.29  
First stage for  $\ln(\text{ETA})$  by region (2015 experiment).

	Dependent variable: $\ln(\text{ETA})$								
	Austin	San Francisco	Los Angeles	Miami	Boston	Seattle	San Diego	Atlanta	New York City
High ETA High Price	0.502*** (0.005)	0.484*** (0.003)	0.492*** (0.003)	0.494*** (0.003)	0.504*** (0.005)	0.515*** (0.006)	0.495*** (0.005)	0.434*** (0.004)	0.432*** (0.002)
High ETA Normal Price	0.488*** (0.004)	0.485*** (0.002)	0.491*** (0.002)	0.491*** (0.002)	0.508*** (0.004)	0.517*** (0.004)	0.492*** (0.004)	0.428*** (0.003)	0.435*** (0.002)
High ETA Low Price	0.496*** (0.004)	0.486*** (0.002)	0.491*** (0.002)	0.492*** (0.002)	0.507*** (0.003)	0.520*** (0.004)	0.495*** (0.004)	0.429*** (0.003)	0.432*** (0.002)
Normal ETA High Price	0.000 (0.004)	0.001 (0.002)	-0.000 (0.002)	0.001 (0.003)	0.006 (0.004)	0.006 (0.005)	0.006 (0.004)	-0.002 (0.004)	-0.003 (0.002)
Normal ETA Low Price	0.000 (0.004)	0.002 (0.002)	-0.000 (0.002)	0.000 (0.003)	0.000 (0.004)	0.009* (0.005)	0.002 (0.004)	-0.002 (0.004)	-0.001 (0.002)
Controls	x	x	x	x	x	x	x	x	x
$N$	218666	1387300	1044273	501297	345974	266222	282393	222981	908252
$R^2$	0.515	0.478	0.497	0.516	0.493	0.507	0.519	0.481	0.457
$F$	7131***	28858***	24306***	16708***	8919***	6078***	6957***	8216***	29963***

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $F$  test is of the null that all the coefficients on the instruments equal 0. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.30  
First stage for  $\ln(1 + \text{PT})$  by region (2015 experiment).

<i>Dependent variable: <math>\ln(1 + \text{PT})</math></i>									
	Austin	San Francisco	Los Angeles	Miami	Boston	Seattle	San Diego	Atlanta	New York City
High ETA High Price	0.003 (0.002)	0.062*** (0.001)	0.042*** (0.001)	0.030*** (0.001)	0.061*** (0.002)	0.055*** (0.002)	0.018*** (0.002)	0.015*** (0.001)	0.072*** (0.001)
High ETA Normal Price	-0.002* (0.001)	0.001 (0.001)	0.001** (0.000)	0.001 (0.001)	-0.001 (0.001)	0.003** (0.001)	-0.000 (0.001)	0.001 (0.001)	0.000 (0.001)
High ETA Low Price	-0.035*** (0.001)	-0.057*** (0.001)	-0.023*** (0.000)	-0.039*** (0.001)	-0.043*** (0.001)	-0.049*** (0.001)	-0.027*** (0.001)	-0.024*** (0.001)	-0.047*** (0.000)
Normal ETA High Price	0.009*** (0.001)	0.065*** (0.001)	0.041*** (0.001)	0.027*** (0.001)	0.060*** (0.001)	0.055*** (0.002)	0.020*** (0.001)	0.013*** (0.001)	0.072*** (0.001)
Normal ETA Low Price	-0.037*** (0.001)	-0.057*** (0.001)	-0.023*** (0.000)	-0.039*** (0.001)	-0.044*** (0.001)	-0.048*** (0.001)	-0.027*** (0.001)	-0.023*** (0.001)	-0.047*** (0.000)
Controls	x	x	x	x	x	x	x	x	x
<i>N</i>	218666	1387300	1044273	501297	345974	266222	282393	222981	908252
<i>R</i> <sup>2</sup>	0.406	0.254	0.300	0.283	0.219	0.297	0.345	0.221	0.227
<i>F</i>	636***	7822***	3889***	1803***	2319***	1569***	822***	785***	6891***

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. *F* test is of the null that all the coefficients on the instruments equal 0. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table C.31  
Counts of geohash7s per region in experiment 2.

Region	Observed geohash7s	Total geohash7s
<b>Atlanta</b>	84046	130643
<b>New York City</b>	41951	62148
<b>Boston</b>	44413	633542
<b>Chicago</b>	80633	883088
<b>Washington, D.C.</b>	67422	364094
<b>Los Angeles</b>	122626	314864
<b>Miami</b>	82108	763292
<b>New Jersey</b>	103103	1269121
<b>Philadelphia</b>	43829	235351
<b>San Francisco</b>	60933	293467

Notes: A geohash7 is considered “observed” if it has at least one session in the experiment sample. Total geohash7 counts include geohash7s which are entirely covered by water.

Table C.32  
ETAs and sample sizes in experiment two.

	Average ETA (minutes)	Number of location- hour blocks	Sessions
<b>Control</b>	3.433 (0.002)	3562926	4861532
<b>Plus 60+ seconds</b>	5.099 (0.003)	1771883	2410230
<b>Plus 150+ seconds</b>	6.332 (0.003)	1060521	1441839
<b>Plus 240+ seconds</b>	7.673 (0.004)	703933	955219

Notes: Standard errors clustered at the geohash7-hour level in parentheses.

Table C.33  
First stage regression of  $\ln(\text{ETA})$  for experiment 2.

	(1)
Plus 60+	0.4827*** (0.0004)
Plus 150+	0.7522*** (0.0004)
Plus 240+	0.9699*** (0.0005)
<hr/>	
Controls	x
<i>N</i>	9668820
<i>R</i> <sup>2</sup>	0.608
<i>F</i>	1644577.2***

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.34  
Regression of  $\ln(1 + \text{PT})$  on experimental treatment indicators for experiment 2.

	(1)
Plus 60+	-0.0003 (0.0003)
Plus 150+	0.0001 (0.0004)
Plus 240+	0.0009 (0.0006)
<hr/>	
Controls	x
<i>N</i>	9668820
<i>R</i> <sup>2</sup>	0.144
<i>F</i>	1.4

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.35  
Time elasticities (2017 experiment).

	Full sample	Destination	No Destination	2017 users in 2015	2015 users in 2017
$\ln(\text{ETA})$	-0.0265*** (0.0004)	-0.0150*** (0.0005)	-0.0268*** (0.0007)	-0.0303*** (0.0029)	-0.0312*** (0.0014)
$\ln(1 + \text{PT})$	-0.2851*** (0.0011)	-0.2002*** (0.0013)	-0.1393*** (0.0013)	-0.3785*** (0.0183)	-0.3169*** (0.0026)
$\ln(\text{Price})$	—	-0.1677*** (0.0003)	—	—	—
<b>ETA Elasticity</b>	-0.0432*** (0.0007)	-0.0202*** (0.0003)	-0.1292*** (0.0034)	-0.0460*** (0.0044)	-0.0467*** (0.0021)
<b>VOT</b>	—	22.15*** (0.67)	—	22.71*** (2.25)	—
<b>Control Avg. ETA</b>	<b>3.43</b>	<b>3.33</b>	<b>3.76</b>	<b>2.72</b>	<b>2.82</b>
<b>Control Avg. Price</b>	<b>11.96</b>	<b>13.85</b>	<b>19.53</b>	<b>12.90</b>	<b>11.37</b>
<b>Control Req. Rate</b>	<b>0.620</b>	<b>0.742</b>	<b>0.228</b>	<b>0.661</b>	<b>0.678</b>
$N$	<b>9668820</b>	<b>7395984</b>	<b>2272839</b>	<b>2098259</b>	<b>711857</b>
$R^2$	<b>0.075</b>	<b>0.110</b>	<b>0.228</b>	<b>0.082</b>	<b>0.106</b>

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses, with clustering for the 2017 data at the hour-geohash7-level and clustering for the 2015 data at the user-level.  $\ln(\text{ETA})$  instrumented by experimental group indicators;  $\ln(1 + \text{PT})$  is instrumented using experimental group indicators. Including controls for region, geohash5, local hour of week, local week of year, business user, and decile of user lifetime rides. Control for airports included for 2015 data.  $\text{Price}$  is the upfront price shown to passengers who enter a destination in the 2017 experiment. VOT for sessions with a destination entered is computed using the coefficient on  $\ln(\text{Price})$  as the price semi-elasticity and the average upfront price shown as the average price. VOT for 2015 users in 2015 is computed using the 2015 PT multiplier semi-elasticity.

2017 prices deflated to December 2015 USD using the Consumer Price Index for All Urban Consumers (U.S. Bureau of Labor Statistics, 2020).

“2017 users in 2015” refers to the sample of sessions in the 2015 experiment from users who appear in both experiments. “2015 users in 2017” refers to the sample of sessions in the 2017 experiment from users who appear in both experiments.

Table C.36  
Time elasticities by day of week in experiment two.

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
$\ln(\text{ETA})$	-0.0261*** (0.0013)	-0.0291*** (0.0012)	-0.0278*** (0.0012)	-0.0295*** (0.0012)	-0.0264*** (0.0011)	-0.0238*** (0.0010)	-0.0237*** (0.0012)
$\ln(1 + \text{PT})$	-0.2978*** (0.0022)	-0.2883*** (0.0026)	-0.3087*** (0.0029)	-0.3151*** (0.0022)	-0.3065*** (0.0018)	-0.2633*** (0.0031)	-0.2664*** (0.0020)
<b>ETA Elasticity</b>	-0.0442*** (0.0021)	-0.0474*** (0.0020)	-0.0440*** (0.0019)	-0.0470*** (0.0019)	-0.0423*** (0.0017)	-0.0391*** (0.0017)	-0.0402*** (0.0020)
<b>Control Avg. ETA</b>	<b>3.65</b>	<b>3.45</b>	<b>3.37</b>	<b>3.38</b>	<b>3.43</b>	<b>3.31</b>	<b>3.49</b>
<b>Control Req. Rate</b>	<b>0.599</b>	<b>0.623</b>	<b>0.640</b>	<b>0.635</b>	<b>0.632</b>	<b>0.616</b>	<b>0.597</b>
<b>Controls</b>	<b>x</b>						
$N$	<b>1246509</b>	<b>1270040</b>	<b>1242952</b>	<b>1228361</b>	<b>1555551</b>	<b>1734742</b>	<b>1390665</b>
$R^2$	<b>0.086</b>	<b>0.080</b>	<b>0.074</b>	<b>0.077</b>	<b>0.079</b>	<b>0.070</b>	<b>0.082</b>

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.37  
Time elasticities by time of day (weekdays) in experiment two.

	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0391*** (0.0012)	−0.0248*** (0.0010)	−0.0320*** (0.0013)	−0.0220*** (0.0010)	−0.0226*** (0.0015)
ln(1 + PT)	−0.3450*** (0.0018)	−0.2972*** (0.0022)	−0.3106*** (0.0022)	−0.2832*** (0.0024)	−0.2503*** (0.0029)
ETA Elasticity	−0.0607*** (0.0019)	−0.0411*** (0.0017)	−0.0521*** (0.0021)	−0.0353*** (0.0017)	−0.0368*** (0.0025)
Control Avg. ETA	3.61	3.51	3.66	2.96	3.69
Control Req. Rate	0.655	0.610	0.622	0.628	0.620
Controls	x	x	x	x	x
<i>N</i>	1215158	1831566	1228901	1472841	794947
<i>R</i> <sup>2</sup>	0.092	0.068	0.079	0.091	0.080

Notes: \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1. Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.38  
Time elasticities by time of day (weekends) in experiment two.

	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0342*** (0.0026)	−0.0278*** (0.0015)	−0.0268*** (0.0019)	−0.0198*** (0.0016)	−0.0169*** (0.0016)
ln(1 + PT)	−0.3083*** (0.0038)	−0.3124*** (0.0025)	−0.2974*** (0.0034)	−0.2559*** (0.0035)	−0.2296*** (0.0029)
ETA Elasticity	−0.0599*** (0.0045)	−0.0484*** (0.0026)	−0.0445*** (0.0032)	−0.0327*** (0.0026)	−0.0262*** (0.0024)
Control Avg. ETA	3.93	3.57	3.42	3.31	2.97
Control Req. Rate	0.580	0.582	0.610	0.611	0.650
Controls	x	x	x	x	x
<i>N</i>	320032	901858	507669	691344	704504
<i>R</i> <sup>2</sup>	0.079	0.073	0.079	0.090	0.073

Notes: \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1. Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.39  
Time elasticities by precipitation type in experiment two.

	No Precipitation	Rain
ln(ETA)	-0.0261*** (0.0005)	-0.0277*** (0.0010)
ln(1 + PT)	-0.2783*** (0.0015)	-0.3072*** (0.0015)
<b>ETA Elasticity</b>	-0.0421*** (0.0008)	-0.0473*** (0.0017)
<b>Control Avg. ETA</b>	<b>3.38</b>	<b>3.61</b>
<b>Control Req. Rate</b>	<b>0.628</b>	<b>0.595</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	<b>7586012</b>	<b>2061855</b>
<i>R</i> <sup>2</sup>	<b>0.074</b>	<b>0.071</b>

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.40  
Time elasticities by whether business user in experiment two.

	Not Business User	Business User
ln(ETA)	-0.0259*** (0.0005)	-0.0334*** (0.0015)
ln(1 + PT)	-0.2853*** (0.0012)	-0.2850*** (0.0028)
<b>ETA Elasticity</b>	-0.0426*** (0.0008)	-0.0491*** (0.0022)
<b>Control Avg. ETA</b>	<b>3.47</b>	<b>2.88</b>
<b>Control Req. Rate</b>	<b>0.615</b>	<b>0.689</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	<b>9002541</b>	<b>666279</b>
<i>R</i> <sup>2</sup>	<b>0.074</b>	<b>0.089</b>

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

**Table C.41**  
Time elasticities by region in experiment two.

	San Francisco	New York City	Chicago	D.C.	Miami	New Jersey	Boston	Philadelphia	Atlanta	Los Angeles
ln(ETA)	-0.0221*** (0.0010)	-0.0445*** (0.0012)	-0.0251*** (0.0012)	-0.0328*** (0.0015)	-0.0136*** (0.0015)	-0.0279*** (0.0020)	-0.0326*** (0.0016)	-0.0234*** (0.0020)	-0.0215*** (0.0025)	-0.0207*** (0.0011)
ln(1 + PT)	-0.2496*** (0.0024)	-0.3741*** (0.0022)	-0.2844*** (0.0024)	-0.2923*** (0.0021)	-0.1366*** (0.0057)	-0.2978*** (0.0028)	-0.3523*** (0.0021)	-0.2579*** (0.0034)	-0.1908*** (0.0045)	-0.2379*** (0.0039)
ETA Elasticity	-0.0307*** (0.0014)	-0.0856*** (0.0024)	-0.0394*** (0.0018)	-0.0543*** (0.0025)	-0.0211*** (0.0023)	-0.0530*** (0.0038)	-0.0552*** (0.0027)	-0.0397*** (0.0034)	-0.0367*** (0.0043)	-0.0330*** (0.0017)
Control Avg. ETA	2.70	3.24	2.96	3.54	3.23	5.11	3.47	3.68	4.99	3.34
Control Req. Rate	0.727	0.532	0.645	0.613	0.647	0.534	0.599	0.597	0.591	0.633
Controls	x	x	x	x	x	x	x	x	x	x
<i>N</i>	1346530	1289094	1117826	908843	812250	651194	690288	482477	496835	1873483
<i>R</i> <sup>2</sup>	0.075	0.067	0.070	0.059	0.051	0.069	0.084	0.065	0.060	0.060

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

**Table C.42**  
Time elasticities by whether session downtown in experiment two.

	Non-Downtown	Downtown
ln(ETA)	-0.0271*** (0.0008)	-0.0258*** (0.0005)
ln(1 + PT)	-0.2707*** (0.0028)	-0.2940*** (0.0010)
ETA Elasticity	-0.0477*** (0.0014)	-0.0392*** (0.0008)
Control Avg. ETA	4.35	2.38
Control Req. Rate	0.576	0.668
Controls	x	x
<i>N</i>	4319737	4969830
<i>R</i> <sup>2</sup>	0.062	0.070

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.43  
Time elasticities by distance to public transit in experiment two.

	Under 50 Meters	50 to 200 Meters	200 to 800 Meters	Over 800 Meters
ln(ETA)	-0.0274*** (0.0008)	-0.0241*** (0.0006)	-0.0281*** (0.0011)	-0.0416*** (0.0026)
ln(1 + PT)	-0.2863*** (0.0016)	-0.2883*** (0.0011)	-0.2853*** (0.0036)	-0.2505*** (0.0045)
ETA Elasticity	-0.0417*** (0.0013)	-0.0383*** (0.0009)	-0.0494*** (0.0019)	-0.0841*** (0.0052)
Control Avg. ETA	2.65	3.07	4.11	6.63
Control Req. Rate	0.666	0.636	0.576	0.503
Controls	x	x	x	x
$N$	1984715	4837325	2292367	554413
$R^2$	0.069	0.071	0.073	0.080

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.44  
Summary statistics for sessions with and without destination entered in experiment 2. Standard errors in parentheses.

	Without destination	With destination
<b>Average ETA (minutes)</b>	5.114 (0.003)	4.572 (0.001)
<b>Average PT (%)</b>	13.283 (0.037)	15.143 (0.041)
<b>Request Rate (%)</b>	20.729 (0.030)	73.707 (0.017)

Table C.45  
Time elasticities by whether destination entered in experiment 2

	Without Destination	With Destination
$\ln(\text{ETA})$	-0.0268*** (0.0007)	-0.0148*** (0.0005)
$\ln(1 + \text{PT})$	-0.1393*** (0.0013)	-0.1990*** (0.0014)
$\ln(\text{Price})$	—	-0.1668*** (0.0005)
<b>ETA Elasticity</b>	-0.1292*** (0.0034)	-0.0202*** (0.0007)
<b>VOT</b>	—	22.66*** (0.77)
<b>Control Avg. ETA</b>	<b>3.76</b>	<b>3.34</b>
<b>Control Req. Rate</b>	<b>0.216</b>	<b>0.742</b>
<b>Control Avg. Price</b>	—	<b>14.22</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	2272839	7422265
<i>R</i> <sup>2</sup>	0.228	0.073

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides. Value of time calculated using the semi-elasticity of price.

Table C.46  
Convexity by whether session was downtown.

	Non-downtown	Downtown
<b>Control — Plus 60</b>	-0.034*** (0.002)	-0.022*** (0.001)
<b>Control — Plus 150</b>	-0.046*** (0.001)	-0.031*** (0.001)
<b>Control — Plus 240</b>	-0.055*** (0.001)	-0.051*** (0.001)

*Notes:* Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental group indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.47  
Convexity by day of week.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Control — Plus 60	-0.020*** (0.003)	-0.030*** (0.003)	-0.026*** (0.003)	-0.033*** (0.003)	-0.028*** (0.002)	-0.025*** (0.003)	-0.027*** (0.003)
Control — Plus 150	-0.037*** (0.002)	-0.039*** (0.002)	-0.037*** (0.002)	-0.040*** (0.002)	-0.038*** (0.002)	-0.034*** (0.002)	-0.035*** (0.002)
Control — Plus 240	-0.058*** (0.002)	-0.060*** (0.002)	-0.057*** (0.002)	-0.057*** (0.002)	-0.050*** (0.001)	-0.045*** (0.002)	-0.050*** (0.002)

Notes: Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental group indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.48  
Convexity by time of day (weekdays).

	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
Control — Plus 60	-0.039*** (0.002)	-0.025*** (0.002)	-0.030*** (0.003)	-0.022*** (0.003)	-0.021*** (0.004)
Control — Plus 150	-0.050*** (0.002)	-0.038*** (0.002)	-0.044*** (0.002)	-0.026*** (0.002)	-0.034*** (0.003)
Control — Plus 240	-0.076*** (0.001)	-0.052*** (0.001)	-0.066*** (0.002)	-0.044*** (0.002)	-0.042*** (0.002)

Notes: Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental group indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.49  
Convexity by time of day (weekends).

	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
Control — Plus 60	-0.035*** (0.005)	-0.028*** (0.004)	-0.032*** (0.004)	-0.024*** (0.004)	-0.019*** (0.004)
Control — Plus 150	-0.057*** (0.004)	-0.042*** (0.002)	-0.040*** (0.003)	-0.024*** (0.003)	-0.024*** (0.003)
Control — Plus 240	-0.071*** (0.003)	-0.058*** (0.002)	-0.054*** (0.003)	-0.041*** (0.002)	-0.029*** (0.003)

Notes: Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental group indicators. Controls include local week of year, local hour of week, user geohash5, business user, and decile of pre-experiment lifetime rides.

**Table C.50**  
**VOT estimates at different ETA treatment levels.**

	All Six Regions	San Francisco	Los Angeles	Miami	Boston	Atlanta	New York City
ETA Elasticity (Plus 60+)	-0.028*** (0.002)	-0.015*** (0.003)	-0.027*** (0.003)	-0.015*** (0.004)	-0.038*** (0.005)	-0.025*** (0.007)	-0.054*** (0.004)
ETA Elasticity (Plus 150+)	-0.036*** (0.001)	-0.025*** (0.002)	-0.026*** (0.002)	-0.019*** (0.003)	-0.046*** (0.004)	-0.032*** (0.006)	-0.080*** (0.003)
ETA Elasticity (Plus 240+)	-0.050*** (0.001)	-0.039*** (0.002)	-0.040*** (0.002)	-0.024*** (0.003)	-0.067*** (0.004)	-0.044*** (0.006)	-0.099*** (0.003)
PT Elasticity (2015)	-0.609*** (0.035)	-0.469*** (0.046)	-0.482*** (0.105)	-0.482*** (0.127)	-0.531*** (0.112)	-0.901*** (0.313)	-0.968*** (0.062)
VOT (Plus 60+)	11.19*** (0.90)	8.98*** (1.73)	11.73*** (2.85)	6.44*** (2.46)	16.16*** (3.98)	4.10** (1.88)	21.28*** (2.14)
VOT (Plus 150+)	14.45*** (0.96)	14.84*** (1.83)	11.48*** (2.68)	7.97*** (2.50)	19.45*** (4.41)	5.35** (2.12)	31.48*** (2.41)
VOT (Plus 240+)	20.04*** (1.24)	23.15*** (2.49)	17.36*** (3.89)	10.32*** (2.98)	27.99*** (6.09)	7.28*** (2.69)	39.09*** (2.78)
Base Avg. ETA (2017)	3.31	2.70	3.34	3.23	3.47	4.99	3.24
Control Avg. Price (2015)	12.50	11.45	10.90	9.65	12.23	11.53	19.90
Controls	x	x	x	x	x	x	x

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  and  $\ln(1 + \text{PT})$  instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

Table C.51  
Summary of cost-benefit analyses and VoT measures used.

Year	Location	Description of Project	Source of VoT	Measure	VoT		
					Original VoT	Adjusted VoT	
2014	San Francisco, CA	SF MUNI public transit system	1/2 of average/median wage (following US DOT 2014 report)	VoT personal	\$17.90	\$26.85	\$20.82
				VoT business/trucks	\$35.50		
				% benefits from VoT	13%	17%	14%
				Total benefits	\$1,897,700,000	\$2,004,690,602	\$1,982,448,621
				Total costs	\$651,791,000		\$651,791,000
				Benefit-cost ratio	2.91	3.08	2.96
2002	Seattle, WA	Monorail "green line" in downtown Seattle	1/2 the average regional wage rate (Washington Employment Security Department)	VoT personal	\$10.10	\$15.15	\$21.31
				VoT business/trucks			
				% benefits from VoT	57%	66%	74%
				Total benefits	\$2,067,264,491	\$2,549,752,571	\$3,140,301,358
				Total costs	\$1,650,000,000		\$1,650,000,000
				Benefit-cost ratio	1.25	1.55	1.90
1998	San Francisco, CA	Electronic toll collector system in Bay Area	1/2 of average/median wage (following US DOT 1996 report)	VoT personal	\$12.75	\$19.13	\$14.33
				VoT business/trucks	\$33.41		
				% benefits from VoT	92%	92%	92%
				Total benefits	\$13,663,608	\$19,877,980	\$15,212,255
				Total costs	\$2,884,584		\$2,884,584
				Benefit-cost ratio	4.74	6.89	5.27
2000	Los Angeles, CA	Improved bus service, pedestrian/bike facilities, roads	1/2 statewide average hourly wage for personal vehicles	VoT personal	\$13.25	\$19.88	\$14.47
				VoT business/trucks	\$31.05		
				% benefits from VoT	63%	72%	65%
				Total benefits	\$599,000,000	\$789,000,000	\$633,851,466
				Total costs	\$255,000,000		\$255,000,000
				Benefit-cost ratio	2.35	3.09	2.49
2000	Los Angeles, CA	Freeway tunnel construction, single bore tunnel with tolls	1/2 statewide average hourly wage for personal vehicles	VoT personal	\$13.25	\$19.88	\$14.47
				VoT business/trucks	\$31.05		
				% benefits from VoT	75%	82%	77%
				Total benefits	\$3,503,000,000	\$4,815,500,000	\$3,743,750,255
				Total costs	\$1,979,000,000		\$1,979,000,000
				Benefit-cost ratio	1.77	2.43	1.89
2017	Atlanta, GA	Pedestrian/cyclist roadway construction	1/2 of average/median wage (following US DOT 2018 grant guidance report)	VoT personal	\$14.80	\$22.20	\$18.55
				VoT business/trucks			
				% benefits from VoT	8%	11%	10%
				Total benefits	\$143,040,000	\$148,740,000	\$145,931,073
				Total costs	\$86,500,000		\$86,500,000
				Benefit-cost ratio	1.65	1.72	1.69

\*All values of time (VoT) and measures of cost and benefit are given in units of USD in year of project (see first column). When both the business VoT and proportion of business trips are given in the original cost-benefit report, we leave benefit estimation for business travel unchanged and only impute our estimate for the personal value of time. Otherwise, (when not given a proportion for business travel trips) total benefit from business VoT is assumed to increase/decrease proportionally with the personal VoT (i.e. If we adjust the personal travel VoT by 10%, we also adjust the business travel VoT by 10%). This likely does not change results by much, since in analyses that report business travel trip counts, the proportion of travel that is business-related is generally a small proportion of total travel (between 5-9%).

## D Lateness regressions

In the regressions in Table D.1, we add a control for the lateness that passengers experienced on their most recent trip with Lyft. The effect we aim to capture is the impact of reliability on future demand. In the first specification (Column 2), the lateness term is the difference between actual and expected arrival times. The difference between actual and expected time to arrival enters linearly; early arrivals correspond to negative values of the “Lateness” variable. In the second specification (Column 3), the lateness term is the difference between actual and expected times to arrival, conditional on being late, and zero otherwise. In this specification, all early arrivals are treated the same (earlier arrivals do not move the “lateness” variable more). Finally, in the third specification (Column 4), the lateness term is zero for arrivals that weren’t late, and the logged difference otherwise.

In all the specifications, we find that the coefficient on lateness is negative, though very close to zero, suggesting that lateness may slightly decrease future demand, but by a relatively small amount. For example, in the first specification, we find a coefficient of  $-0.0001$  on the difference between actual and expected times to arrival. This translates to a decrease in request rate of  $-0.01$  percentage points per minute increase in prior lateness.

One feature to note is that these analyses only include the 62% of sessions in our data that had previous rides associated with that passenger. The request rate increases a fair amount when we drop the users who hadn’t had previous rides (from 64% to 71%). Furthermore, since passengers without sessions do not show up in our data, we are only considering the effect of lateness, conditional on the passenger returning to the platform after their experience.

Table D.1  
Second stage regression results, with controls for lateness of previous ride.

With controls for lateness of last experience (experiment 1)				
	No control	$(ATA - ETA)$	$\mathbb{1}_{late}(ATA - ETA)$	$\mathbb{1}_{late} \ln(ATA - ETA)$
ln(ETA)	-0.022*** (0.002)	-0.022*** (0.002)	-0.022*** (0.002)	-0.022*** (0.002)
ln(1 + PT)	-0.320*** (0.016)	-0.320*** (0.016)	-0.320*** (0.016)	-0.320*** (0.016)
Lateness	—	-0.0001*** (0.0000)	-0.0001** (0.0000)	-0.0033*** (0.0003)
ETA Elasticity	-0.032*** (0.003)	-0.032*** (0.003)	-0.032*** (0.003)	-0.031*** (0.003)
PT Elasticity	-0.459*** (0.023)	-0.458*** (0.023)	-0.458*** (0.023)	-0.458*** (0.023)
VOT	19.28*** (1.79)	19.28*** (1.79)	19.27*** (1.79)	19.01*** (1.79)
Control Avg. ETA	2.91	2.91	2.91	2.91
Control Avg. Price	13.44	13.44	13.44	13.44
Control Req. Rate	0.699	0.699	0.699	0.699
Controls	x	x	x	x
$N$	3103899	3103899	3103899	3103899
$R^2$	0.058	0.058	0.058	0.058

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Including controls for region, geohash5, local hour of week, local week of year, business user, airport session, and decile of user lifetime rides. The results in this table are from a regression of the form:  $Request = \beta_0 \beta_1 \ln(ETA) + \beta_2 \ln(1 + PT) \beta_3 Lateness + \sum_k \gamma_k X_k$ , where the measure of lateness is from the most recent trip that the rider took prior to that session and  $X$  are the controls. The measures of lateness that we examine include (1) the difference between ATA and ETA for the last ride (in minutes), (2) the difference between ATA and ETA for the last ride if the arrival was late, and (3) the logged difference between ATA and ETA if the arrival was late. Arrivals were tagged as late if  $ATA - ETA > 0$ . We subset to sessions where the passenger had prior ride experience; this consists of 62% of the full sample.

Similarly, in the 2017 experiment, we add the controls for lateness and find that the elasticity estimates are unchanged. Removing the sessions where the user did not have a previous ride (and thus no previous lateness experience), we limit our sample to 64% of the original sample. Again, the request rate in this group is a bit higher than the request rate in the full 2017 sample.

Table D.2

Second stage regression results (2017 experiment), with controls for lateness of previous ride.

With controls for lateness of last experience				
	No control	$(ATA - ETA)$	$\mathbb{1}_{late}(ATA - ETA)$	$\mathbb{1}_{late} \ln(ATA - ETA)$
$\ln(ETA)$	-0.036*** (0.001)	-0.036*** (0.001)	-0.036*** (0.001)	-0.036*** (0.001)
$\ln(1 + PT)$	-0.293*** (0.001)	-0.292*** (0.001)	-0.292*** (0.001)	-0.292*** (0.001)
Lateness	—	-0.0000*** (0.0000)	-0.0024*** (0.0002)	-0.0069*** (0.0002)
ETA Elasticity	-0.051*** (0.001)	-0.051*** (0.001)	-0.051*** (0.001)	-0.051*** (0.001)
Control Avg. ETA	3.25	3.25	3.25	3.25
Control Avg. Price	11.81	11.81	11.81	11.81
Control Req. Rate	0.714	0.714	0.714	0.714
Controls	x	x	x	x
$N$	6176908	6176908	6176908	6176908
$R^2$	0.052	0.052	0.052	0.052

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(ETA)$  instrumented by experimental group indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

## E Demand Effects After End of Experiment

We next turn to analyzing whether and how exposure to the ETA and price treatments during the experiment affects passenger behavior after the experiment’s conclusion. This is an important issue because to understand long-term welfare consequences from these medium-run changes in price and time changes. We use the following reduced-form approach: for each week after the experiment’s conclusion, we calculate the number of sessions and the number of sessions with a request that passenger had in that week, and that passenger’s average request rate (if they had at least one session). For each week after the experiment, we regress each passenger’s session count, request count, and request rate on the indicators of exposure to each of the experimental treatments. If there are no lasting effects of the treatments on demand, then these regressions should find no significant differences in demand behavior across the treatment groups. Moreover, comparing results across multiple weeks of the experiment gives a sense of the rate with which lasting demand effects decay.

First, we confirm that the experimental treatments stop affecting ETA and PT after the end of experiment, by regressing  $\ln(\text{ETA})$  and  $\ln(1 + \text{PT})$  on the experimental indicators, split up across weeks. Tables E.1 and E.2 give the results of these regressions. While there are some significant treatment effects on ETA and PT in the first two weeks after the experiment,<sup>64</sup> by the third week after the experiment, there remains little evidence of any statistically significant effects, and what evidence does remain appears economically negligible.

Next, Tables E.3, E.4, and E.5 show the effects of the experimental treatments on users’ numbers of sessions, numbers of sessions with requests, and request rates in each week after the experiment, respectively. We do not find any meaningful demand effects even twelve weeks after the end of the experiment. Passengers exposed to the high-ETA-high-price treatment have about 0.0138 fewer sessions and sessions with request per week than the control group. However, the results in Table E.5 suggests that there are no effects on demand conditional on opening up the app. Overall, while passengers exposed to higher ETAs and prices return to Lyft slightly less frequent in the immediate future, once they open the app again, their past experience does not appear to significantly affect their probability of requesting a ride.

---

<sup>64</sup>These effects were caused by a technical glitch that arose when disabling the experiment.

Table E.1

Regressions of session  $\ln(\text{ETA})$  on the experimental treatment indicators by week. Week 0 is first week after the end of the experiment.

	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11
High ETA High Price	0.478*** (0.003)	0.477*** (0.003)	-0.002 (0.004)	0.405*** (0.003)	0.001 (0.004)	-0.000 (0.004)	0.007* (0.004)	0.004 (0.004)	-0.000 (0.004)	-0.000 (0.004)	0.004 (0.004)	0.002 (0.004)	0.007* (0.004)	0.001 (0.004)
High ETA Normal Price	0.478*** (0.002)	0.480*** (0.002)	-0.003 (0.002)	0.397*** (0.002)	-0.002 (0.002)	0.001 (0.002)	0.000 (0.002)	-0.003 (0.002)	0.004 (0.002)	-0.000 (0.002)	0.002 (0.002)	0.006** (0.003)	0.006** (0.003)	0.001 (0.003)
High ETA Low Price	0.478*** (0.002)	0.480*** (0.002)	-0.003 (0.002)	0.397*** (0.002)	0.002 (0.002)	0.001 (0.002)	0.000 (0.002)	-0.002 (0.002)	0.004* (0.002)	0.001 (0.002)	0.006** (0.002)	0.001 (0.003)	0.001 (0.003)	-0.003 (0.003)
Normal ETA High Price	0.002 (0.002)	-0.000 (0.002)	0.245*** (0.002)	0.003 (0.002)	0.002 (0.002)	-0.002 (0.002)	0.000 (0.002)	-0.003 (0.002)	0.000 (0.002)	0.002 (0.002)	0.002 (0.002)	-0.001 (0.003)	0.000 (0.003)	-0.000 (0.003)
Normal ETA Low Price	0.002 (0.002)	-0.001 (0.002)	0.244*** (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	0.002 (0.002)	0.001 (0.002)	0.000 (0.002)	0.001 (0.003)	0.003 (0.003)	0.001 (0.003)
Controls	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N	705870	690470	618570	614975	656352	587628	600938	600625	609180	626015	554877	500449	521414	525224
R <sup>2</sup>	0.556	0.569	0.515	0.544	0.450	0.452	0.458	0.449	0.445	0.448	0.461	0.443	0.435	0.416
F	29676***	26397***	5024***	15808***	1	0	1	1	1	1	0	1	2	0

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $F$  test is of the null that all the coefficients on the instruments equal 0. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table E.2

Regressions of session  $\ln(1 + \text{PT})$  on the experimental treatment indicators by week. Week 0 is first week after the end of the experiment.

	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11
High ETA High Price	0.047*** (0.001)	0.038*** (0.001)	0.043*** (0.001)	0.021*** (0.001)	-0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.000 (0.002)
High ETA Normal Price	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.002* (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)
High ETA Low Price	-0.031*** (0.000)	-0.040*** (0.000)	-0.036*** (0.000)	-0.055*** (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)
Normal ETA High Price	0.047*** (0.001)	0.038*** (0.001)	0.044*** (0.001)	0.021*** (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)
Normal ETA Low Price	-0.031*** (0.000)	-0.039*** (0.000)	-0.036*** (0.000)	-0.056*** (0.001)	0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.001 (0.001)
Controls	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N	705870	690470	618570	614975	656352	587628	600938	600625	609180	626015	554877	500449	521414	525224
R <sup>2</sup>	0.251	0.184	0.187	0.189	0.309	0.305	0.218	0.261	0.296	0.307	0.207	0.224	0.200	0.183
F	3895***	4813***	4638***	3760***	0	0	0	1	1	1	1	1	1	0

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $F$  test is of the null that all the coefficients on the instruments equal 0. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table E.3

Regressions of number of sessions per user on the experimental treatment indicators by week. Week 0 is first week after the end of the experiment.

	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11
High ETA High Price	-0.069*** (0.010)	-0.065*** (0.010)	-0.066*** (0.010)	-0.100*** (0.010)	-0.072*** (0.010)	-0.061*** (0.010)	-0.049*** (0.010)	-0.059*** (0.010)	-0.055*** (0.010)	-0.055*** (0.010)	-0.042*** (0.010)	-0.044*** (0.009)	-0.045*** (0.009)	-0.041*** (0.009)
High ETA Normal Price	-0.040*** (0.007)	-0.031*** (0.007)	-0.039*** (0.007)	-0.044*** (0.007)	-0.043*** (0.007)	-0.037*** (0.007)	-0.034*** (0.007)	-0.032*** (0.007)	-0.030*** (0.007)	-0.033*** (0.007)	-0.030*** (0.007)	-0.018*** (0.006)	-0.014** (0.006)	-0.015** (0.006)
High ETA Low Price	-0.026*** (0.007)	-0.026*** (0.007)	-0.018*** (0.007)	-0.024*** (0.007)	-0.019*** (0.007)	-0.023*** (0.007)	-0.012* (0.007)	-0.020*** (0.007)	-0.022*** (0.007)	-0.022*** (0.007)	-0.020*** (0.007)	-0.015** (0.006)	-0.011* (0.006)	-0.016** (0.006)
Normal ETA High Price	-0.032*** (0.007)	-0.027*** (0.007)	-0.028*** (0.007)	-0.039*** (0.007)	-0.034*** (0.007)	-0.024*** (0.007)	-0.029*** (0.007)	-0.020*** (0.007)	-0.022*** (0.007)	-0.022*** (0.007)	-0.024*** (0.007)	-0.013** (0.006)	-0.016** (0.006)	-0.012* (0.006)
Normal ETA Low Price	0.016** (0.007)	0.016** (0.007)	0.020*** (0.007)	0.003 (0.007)	0.016** (0.007)	0.008 (0.007)	0.008 (0.007)	0.007 (0.007)	0.015** (0.007)	0.009 (0.007)	0.002 (0.007)	0.008 (0.006)	0.006 (0.006)	0.004 (0.006)
Controls	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059
R <sup>2</sup>	0.080	0.078	0.097	0.111	0.111	0.116	0.116	0.120	0.119	0.111	0.108	0.104	0.106	0.102
F	19***	16***	20***	31***	21***	16***	12***	12***	13***	12***	9***	9***	7***	6***

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Heteroskedasticity-robust standard errors in parentheses.  $F$  test is of the null that all the coefficients on the instruments equal 0. Controls include decile of lifetime rides and indicator of business user.

Table E.4

Regressions of number of sessions with request per user on the experimental treatment indicators by week. Week 0 is first week after the end of the experiment.

	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11
High ETA High Price	-0.070*** (0.008)	-0.071*** (0.007)	-0.062*** (0.007)	-0.085*** (0.007)	-0.054*** (0.008)	-0.043*** (0.008)	-0.041*** (0.008)	-0.045*** (0.008)	-0.038*** (0.008)	-0.040*** (0.008)	-0.031*** (0.007)	-0.037*** (0.007)	-0.030*** (0.007)	-0.029*** (0.007)
High ETA Normal Price	-0.034*** (0.005)	-0.033*** (0.005)	-0.030*** (0.005)	-0.040*** (0.005)	-0.030*** (0.005)	-0.024*** (0.005)	-0.025*** (0.005)	-0.024*** (0.005)	-0.022*** (0.005)	-0.024*** (0.006)	-0.020*** (0.005)	-0.014*** (0.005)	-0.008* (0.005)	-0.011** (0.005)
High ETA Low Price	-0.018*** (0.005)	-0.016*** (0.005)	-0.001 (0.005)	-0.009* (0.005)	-0.010* (0.005)	-0.011** (0.005)	-0.008 (0.006)	-0.012** (0.005)	-0.014** (0.006)	-0.019*** (0.006)	-0.016*** (0.005)	-0.009* (0.005)	-0.005 (0.005)	-0.011** (0.005)
Normal ETA High Price	-0.040*** (0.005)	-0.034*** (0.005)	-0.045*** (0.005)	-0.042*** (0.005)	-0.028*** (0.005)	-0.018*** (0.005)	-0.022*** (0.005)	-0.009* (0.005)	-0.015*** (0.006)	-0.021*** (0.006)	-0.018*** (0.005)	-0.013*** (0.005)	-0.011** (0.005)	-0.011** (0.005)
Normal ETA Low Price	0.019*** (0.006)	0.027*** (0.006)	0.019*** (0.005)	0.020*** (0.005)	0.010* (0.005)	0.008 (0.005)	0.003 (0.005)	0.004 (0.005)	0.011** (0.006)	0.005 (0.006)	-0.001 (0.005)	0.005 (0.005)	0.006 (0.005)	0.003 (0.005)
Controls	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059	720059
R <sup>2</sup>	0.107	0.106	0.121	0.129	0.127	0.129	0.129	0.131	0.128	0.121	0.116	0.111	0.113	0.107
F	38***	40***	40***	54***	21***	13***	12***	11***	11***	11***	7***	9***	6***	6***

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Heteroskedasticity-robust standard errors in parentheses. F test is of the null that all the coefficients on the instruments equal 0. Controls include decile of lifetime rides and indicator of business user.

Table E.5

Regressions of average request rate per user on the experimental treatment indicators by week, for all users with at least one session in that week. Week 0 is first week after the end of the experiment.

	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11
High ETA High Price	-0.036*** (0.004)	-0.036*** (0.004)	-0.029*** (0.004)	-0.038*** (0.004)	-0.007* (0.004)	-0.005 (0.004)	-0.017*** (0.004)	-0.012*** (0.004)	-0.003 (0.004)	-0.006 (0.004)	0.001 (0.004)	-0.007* (0.004)	-0.003 (0.004)	-0.003 (0.004)
High ETA Normal Price	-0.013*** (0.003)	-0.015*** (0.003)	-0.006** (0.003)	-0.018*** (0.003)	-0.005* (0.003)	-0.002 (0.003)	-0.007** (0.003)	-0.005* (0.003)	-0.006** (0.003)	-0.004 (0.003)	-0.002 (0.003)	-0.003 (0.003)	0.001 (0.003)	-0.003 (0.003)
High ETA Low Price	-0.003 (0.003)	0.002 (0.003)	0.012*** (0.003)	0.004 (0.003)	-0.001 (0.003)	0.000 (0.003)	-0.003 (0.003)	-0.002 (0.003)	-0.003 (0.003)	-0.007*** (0.003)	-0.006** (0.003)	-0.004 (0.003)	0.000 (0.003)	-0.004 (0.003)
Normal ETA High Price	-0.022*** (0.003)	-0.018*** (0.003)	-0.033*** (0.003)	-0.020*** (0.003)	-0.007*** (0.003)	-0.005* (0.003)	-0.002 (0.003)	0.003 (0.003)	-0.001 (0.003)	-0.006** (0.003)	-0.002 (0.003)	-0.006** (0.003)	-0.004 (0.003)	-0.002 (0.003)
Normal ETA Low Price	0.011*** (0.002)	0.018*** (0.002)	0.007*** (0.003)	0.023*** (0.003)	-0.001 (0.003)	0.005* (0.003)	0.000 (0.003)	-0.002 (0.003)	0.003 (0.003)	0.001 (0.003)	0.001 (0.003)	0.001 (0.003)	-0.001 (0.003)	0.004 (0.003)
Controls	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N	246021	241777	211156	209537	214997	197686	199483	197628	197285	200569	186401	179396	184503	185825
R <sup>2</sup>	0.061	0.065	0.072	0.070	0.057	0.059	0.058	0.054	0.051	0.048	0.050	0.044	0.044	0.041
F	44***	54***	55***	64***	2**	2**	4***	3**	2	3**	1	2	1	1

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Heteroskedasticity-robust standard errors in parentheses. F test is of the null that all the coefficients on the instruments equal 0. Controls include decile of lifetime rides and indicator of business user.

## F Time to Destination

In this section, we consider the potential bias that may arise in our estimate of the price equivalent of waiting time (PEWT) by failing to account for the effect of in-vehicle time on demand. Suppose the utility a passenger receives from taking a Lyft trip at Prime Time level PT, waiting time (ETA)  $WT$ , and in-vehicle time  $IVT$  can be written

$$U = \beta_0 + \beta_1 \ln(1 + PT) + \beta_2 \ln(WT) + \beta_3 \ln(IVT) + controls + \varepsilon, \quad (22)$$

but we ignore the  $\ln(IVT)$  term. Note that Lyft did not show IVT estimates during the experiments, so  $\ln(IVT)$  captures the passenger's perceived waiting time. Our estimate of  $\beta_2$  will suffer from omitted variable bias, converging in probability to

$$\beta_2 + \delta\beta_3 \quad (23)$$

where  $\delta$  is the coefficient on  $\ln(WT)$  in a regression of  $\ln(IVT)$  on  $\ln(WT)$  and controls. Instrumenting  $\ln(WT)$  with our experimental treatment indicators will *not* remove this bias if changes in quoted waiting time affect a passenger's estimate of the in-vehicle time.<sup>65</sup>

Using existing estimates from the literature on the relative values of waiting and in-vehicle time, we can assess the asymptotic bias of our estimate of the price-equivalent of waiting time (PEWT). In particular, given the omitted variable bias from  $\ln(IVT)$ , our estimator of  $PEWT$  is also biased in the limit:

$$\widehat{PEWT} = \frac{\hat{\beta}_2 \bar{P}}{\hat{\beta}_1 \bar{WT}} \quad (24)$$

$$\xrightarrow{p} \frac{(\beta_2 + \delta\beta_3) \bar{P}}{\beta_1 \bar{WT}} \quad (25)$$

$$= \frac{\beta_2 \bar{P}}{\beta_1 \bar{WT}} + \delta \frac{\overline{IVT}}{\bar{WT}} \frac{\beta_3 \bar{P}}{\beta_1 \overline{IVT}} \quad (26)$$

$$= PEWT + \delta \frac{\overline{IVT}}{\bar{WT}} PEIVT, \quad (27)$$

where  $PEIVT$  is the price-equivalent of in-vehicle time. Letting  $\kappa = \frac{PEIVT}{PEWT}$ , we conclude

$$\widehat{PEWT} \xrightarrow{p} \left(1 + \delta\kappa \frac{\overline{IVT}}{\bar{WT}}\right) PEWT, \quad (28)$$

so that our estimate of the price equivalent of waiting time is biased upwards by a factor of  $\left(1 + \delta\kappa \frac{\overline{IVT}}{\bar{WT}}\right)$  in the limit.

---

<sup>65</sup>By design of the experiment, the treatments only impact waiting time and not in-vehicle time. Nonetheless, a long waiting time may lead a passenger to believe that the in-vehicle time will also be longer, by changing the passenger's perception of local traffic conditions.

$\frac{IVT}{WT}$  can be directly computed for completed rides in our sample, and has a value of about 5.  $\delta$  is a parameter reflecting passenger expectations about the relationship between waiting time and in-vehicle time, and so cannot be directly estimated; we approximate it by running a cross-sectional regression of  $\ln(IVT)$  on  $\ln(WT)$  and *controls* for completed rides in our sample, which should capture the (endogenous) relationship between waiting time and in-vehicle time arising from traffic conditions.<sup>66</sup> Using data on completed rides from the 2017 experiment, we estimate this value to be 0.1, which we may interpret to mean that a 10% increase in waiting time is associated with a 1% increase in expected in-vehicle time. We take  $\kappa = 1/2$ .

Plugging these numbers into equation (28), we conclude that the omitted variable bias from in-vehicle time inflates our PEWT estimate by about 25%. Thus, if one believes the purported relationship between quoted waiting time and passenger-estimated in-vehicle time (which, unfortunately, cannot be tested empirically), one should adjust our PEWT estimates downward by a factor of 1.25, to arrive at an overall PEWT of \$15/hour rather than \$19/hour.

For the 2017 experiment, we observe estimated in-vehicle time for all sessions that entered a destination, and can use this data to directly evaluate whether our estimated waiting time effects also reflect the value of in-vehicle time. Table F.1 gives ETA elasticity estimates broken up by quintile of estimated time to drop off. We do not find any clear pattern in the elasticity estimates, supporting the conclusion that our experiments are primarily estimating the value of pre-pickup waiting time, and not a combination of waiting and in-vehicle time.

Table F.1  
ETA elasticities by quintile of estimated trip duration (2017 experiment).

	Q1	Q2	Q3	Q4	Q5
$\ln(\text{ETA})$	-0.0190*** (0.0008)	-0.0146*** (0.0008)	-0.0159*** (0.0009)	-0.0163*** (0.0010)	-0.0133*** (0.0011)
$\ln(1 + \text{PT})$	-0.2667*** (0.0020)	-0.3242*** (0.0019)	-0.3771*** (0.0019)	-0.3880*** (0.0019)	-0.3587*** (0.0021)
ETA Elasticity	-0.0233*** (0.0010)	-0.0181*** (0.0010)	-0.0210*** (0.0012)	-0.0236*** (0.0015)	-0.0233*** (0.0020)
Control Avg. ETA	3.16	3.20	3.22	3.33	3.80
Control Req. Rate	0.819	0.810	0.762	0.693	0.575
Controls	x	x	x	x	x
$N$	1598111	1596340	1593377	1592525	1594672
$R^2$	0.073	0.077	0.085	0.081	0.070

Notes: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental treatment indicators. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides. Bins are quintiles of estimated in-vehicle time, in seconds. The ordered quintiles are 561, 772, 1032, 1455.

<sup>66</sup>The inclusion of location and time controls should partial out some of the endogenous relationship unrelated to traffic conditions, arising, for example, due to the fact that passengers in less driver-dense regions may take longer rides in general.

## G Removing always- and/or never-requesters

In this section, we consider how the estimates of interest change when excluding always-requesters, excluding never-requesters, and excluding both. Our identification strategy of the value of time rests on the assumption that users are cognisant of and internalizing the prices and times displayed in making their decision to request a ride. One concern, however, may be that these estimates include users who do *not* make a decision based on displayed times and prices. While our data does not allow us to precisely determine what enters our users' decision-making process, we can explore how robust our results are to narrowing our focus on passengers who sometimes request and sometimes do not.

Notably, the proportion of always- and/or never-requesters will differ by treatment group, but not by drastic proportions, with most treatments consisting of about 20-22% always-requesters and 19-21% never-requesters.

Table G.1  
Proportion of always- and never-requesters by treatment group (2015 experiment).

Treatment group	Number of users	Prop. always requesters	Prop. never requesters	Prop. always/never requesters
<b>Control</b>	292025	0.21 (0.001)	0.2 (0.001)	0.41 (0.001)
<b>High ETA High Price</b>	38674	0.19 (0.002)	0.22 (0.002)	0.42 (0.003)
<b>High ETA Low Price</b>	97254	0.21 (0.001)	0.2 (0.001)	0.41 (0.002)
<b>High ETA Normal Price</b>	97051	0.2 (0.001)	0.21 (0.001)	0.41 (0.002)
<b>Normal ETA High Price</b>	97185	0.2 (0.001)	0.21 (0.001)	0.41 (0.002)
<b>Normal ETA Low Price</b>	97870	0.21 (0.001)	0.19 (0.001)	0.41 (0.002)

Similarly, we can look at how these proportions differ across regions. There is a fair amount of variation across regions. For example, the proportion of never-requesters ranges from 15.8% (San Francisco) to 28% (Atlanta), reflecting differences in request patterns and Lyft app usage across various locations.

Table G.2  
Proportion of always- and never-requesters by region.

Region	Number of users	Prop. always requesters	Prop. never requesters	Prop. always/never requesters
<b>Atlanta</b>	37238	0.19 (0.002)	0.27 (0.002)	0.47 (0.003)
<b>Austin</b>	34828	0.25 (0.002)	0.18 (0.002)	0.43 (0.003)
<b>New York City</b>	118762	0.18 (0.001)	0.24 (0.001)	0.42 (0.001)
<b>Boston</b>	51332	0.19 (0.002)	0.21 (0.002)	0.4 (0.002)
<b>Los Angeles</b>	169031	0.22 (0.001)	0.2 (0.001)	0.42 (0.001)
<b>Miami</b>	75468	0.18 (0.001)	0.21 (0.001)	0.38 (0.002)
<b>San Diego</b>	47769	0.25 (0.002)	0.23 (0.002)	0.47 (0.002)
<b>Seattle</b>	36003	0.21 (0.002)	0.19 (0.002)	0.4 (0.003)
<b>San Francisco</b>	149628	0.21 (0.001)	0.15 (0.001)	0.36 (0.001)

In the following tables, we remove all sessions of always-requesters (users with a request rate of 100%), of never-requesters (users with a request rate of 0%), and both.

We perform this analysis for various subsets of our population that may be of particular inter-

est and find similar patterns in changes to time and price elasticities and values of time across most of these subsets. Removing the set of sessions of always-requesters tends to yield more elastic estimates of both price and time and a similar value of time, while removing the sessions of never-requesters tends to yield less elastic estimates of price and time, with price elasticity changing much more than the time elasticity, thus decreasing the value of time.

Table G.3  
Second-stage regressions with and without always-/never-requesters.

	Full sample	Without never and always	Without never	Without always
ln(ETA)	-0.026*** (0.002)	-0.027*** (0.002)	-0.022*** (0.002)	-0.023*** (0.002)
ln(1 + PT)	-0.367*** (0.013)	-0.365*** (0.014)	-0.332*** (0.013)	-0.334*** (0.014)
ETA Elasticity	-0.043*** (0.003)	-0.044*** (0.003)	-0.035*** (0.003)	-0.037*** (0.003)
PT Elasticity	-0.594*** (0.021)	-0.592*** (0.023)	-0.539*** (0.021)	-0.541*** (0.022)
VOT	19.38*** (1.39)	20.11*** (1.48)	17.73*** (1.53)	18.48*** (1.60)
Control Avg. ETA	3.08	3.08	3.08	3.08
Control Avg. Price	13.83	13.83	13.83	13.83
Control Req. Rate	0.620	0.620	0.620	0.620
Controls	x	x	x	x
$N$	5177358	4806027	4921221	4549890
$R^2$	0.072	0.084	0.056	0.065

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for geohash5, local hour of week, local week of year, business user, airport session, and decile of user lifetime rides.

Table G.4

Second-stage regressions with and without always-/never-requesters, for business user sessions.

	Full sample	Without never and always	Without never	Without always
ln(ETA)	-0.023** (0.010)	-0.019* (0.010)	-0.020** (0.010)	-0.016 (0.010)
ln(1 + PT)	-0.283*** (0.052)	-0.282*** (0.053)	-0.274*** (0.052)	-0.273*** (0.053)
ETA Elasticity	-0.033** (0.014)	-0.027* (0.014)	-0.028** (0.014)	-0.023 (0.014)
PT Elasticity	-0.398*** (0.073)	-0.397*** (0.076)	-0.385*** (0.072)	-0.384*** (0.075)
VOT	24.42** (10.55)	20.37* (10.71)	21.62** (10.85)	17.78 (11.01)
Control Avg. ETA	2.30	2.30	2.30	2.30
Control Avg. Price	11.38	11.38	11.38	11.38
Control Req. Rate	0.714	0.714	0.714	0.714
Controls	x	x	x	x
$N$	217180	205970	213224	202014
$R^2$	0.096	0.108	0.081	0.090

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for geohash5, local hour of week, local week of year, airport session, and decile of user lifetime rides.

Table G.5

Second-stage regressions with and without always-/never-requesters, for airport sessions.

	Full sample	Without never and always	Without never	Without always
ln(ETA)	-0.014 (0.009)	-0.020** (0.010)	-0.006 (0.010)	-0.011 (0.010)
ln(1 + PT)	-0.335*** (0.092)	-0.283*** (0.096)	-0.248** (0.097)	-0.204** (0.102)
ETA Elasticity	-0.024 (0.015)	-0.033* (0.018)	-0.009 (0.015)	-0.018 (0.017)
PT Elasticity	-0.553*** (0.153)	-0.468*** (0.175)	-0.409*** (0.149)	-0.337** (0.171)
VOT	27.55 (18.02)	45.57* (24.68)	14.91 (24.52)	34.91 (33.70)
Control Avg. ETA	2.92	2.92	2.92	2.92
Control Avg. Price	31.40	31.40	31.40	31.40
Control Req. Rate	0.606	0.606	0.606	0.606
Controls	x	x	x	x
$N$	129088	112222	119819	102953
$R^2$	0.080	0.087	0.077	0.081

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for region, geohash5, local hour of week, local week of year, business user, and decile of user lifetime rides.

**Table G.6**  
**Second-stage regression results without always- and never-requesters, by region.**

	San Francisco	Miami	Los Angeles	Boston	Seattle	San Diego	Austin	Atlanta	New York City
ln(ETA)	-0.0170*** (0.0035)	-0.0219*** (0.0063)	-0.0236*** (0.0042)	-0.0381*** (0.0066)	-0.0266*** (0.0071)	-0.0223*** (0.0072)	-0.0166** (0.0083)	-0.0179* (0.0098)	-0.0265*** (0.0048)
ln(1 + PT)	-0.2785*** (0.0189)	-0.2310*** (0.0641)	-0.2939*** (0.0485)	-0.3399*** (0.0444)	-0.2886*** (0.0507)	-0.3581*** (0.1030)	-0.4752*** (0.1161)	-0.4262*** (0.1582)	-0.4579*** (0.0256)
<b>ETA Elasticity</b>	-0.0239*** (0.0050)	-0.0374*** (0.0108)	-0.0378*** (0.0067)	-0.0646*** (0.0111)	-0.0429*** (0.0114)	-0.0365*** (0.0118)	-0.0259** (0.0130)	-0.0315* (0.0172)	-0.0512*** (0.0092)
<b>PT Elasticity</b>	-0.3921*** (0.0266)	-0.3947*** (0.1094)	-0.4708*** (0.0777)	-0.5765*** (0.0754)	-0.4648*** (0.0817)	-0.5866*** (0.1689)	-0.7410*** (0.1811)	-0.7497*** (0.2783)	-0.8830*** (0.0494)
<b>VOT</b>	20.06*** (4.16)	17.74*** (6.40)	20.13*** (4.75)	23.64*** (4.65)	24.14*** (7.24)	14.98** (5.91)	10.03** (4.93)	6.92* (4.19)	23.19*** (4.22)
Control Avg. ETA	2.08	4.35	2.97	3.61	3.36	3.40	2.77	4.92	3.09
Control Avg. Price	11.39	13.56	12.42	12.70	14.66	13.64	13.25	13.53	20.59
Control Req. Rate	0.710	0.588	0.629	0.596	0.627	0.612	0.644	0.569	0.522
Controls	x	x	x	x	x	x	x	x	x
<i>N</i>	1247246	441748	893844	303445	236524	234723	185909	190384	816067
<i>R</i> <sup>2</sup>	0.069	0.039	0.059	0.049	0.065	0.062	0.050	0.041	0.029

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for user geohash5, local hour of week, local week of year, business user, airport session, and decile of user lifetime rides.

Table G.7

Second-stage regression results without always- and never-requesters, by local day of week.

	Mon	Tues	Wed	Thu	Fri	Sat	Sun
ln(ETA)	-0.0248*** (0.0033)	-0.0262*** (0.0033)	-0.0262*** (0.0033)	-0.0191*** (0.0031)	-0.0212*** (0.0030)	-0.0208*** (0.0028)	-0.0227*** (0.0029)
ln(1 + PT)	-0.3491*** (0.0289)	-0.3838*** (0.0318)	-0.3618*** (0.0312)	-0.3112*** (0.0226)	-0.2791*** (0.0155)	-0.3343*** (0.0204)	-0.3600*** (0.0191)
ETA Elasticity	-0.0409*** (0.0055)	-0.0417*** (0.0052)	-0.0416*** (0.0052)	-0.0310*** (0.0051)	-0.0338*** (0.0047)	-0.0329*** (0.0044)	-0.0380*** (0.0049)
PT Elasticity	-0.5750*** (0.0476)	-0.6116*** (0.0507)	-0.5733*** (0.0495)	-0.5055*** (0.0367)	-0.4453*** (0.0247)	-0.5290*** (0.0323)	-0.6011*** (0.0318)
VOT	18.52*** (2.73)	17.92*** (2.54)	20.01*** (2.83)	16.91*** (2.85)	19.43*** (2.72)	17.56*** (2.40)	16.91*** (2.25)
Control Avg. ETA	3.10	3.00	2.90	3.02	3.32	2.84	3.09
Control Avg. Price	13.45	13.14	13.35	13.88	14.15	13.34	13.79
Control Req. Rate	0.610	0.631	0.634	0.616	0.627	0.634	0.603
Controls	x	x	x	x	x	x	x
$N$	549814	561522	553726	635104	796294	785743	667687
$R^2$	0.075	0.070	0.070	0.063	0.058	0.070	0.078

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1+PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for region, user geohash5, local hour of week, local week of year, business user, airport session, and decile of user lifetime rides.

Table G.8

Second-stage regression results without always- and never-requesters, by time of day (weekdays).

	11PM-6AM	6AM-10AM	10AM-4PM	4PM-7PM	7PM-11PM
ln(ETA)	-0.0419*** (0.0040)	-0.0224*** (0.0035)	-0.0230*** (0.0034)	-0.0131*** (0.0030)	-0.0214*** (0.0038)
ln(1 + PT)	-0.3681*** (0.0234)	-0.3654*** (0.0374)	-0.2814*** (0.0220)	-0.3006*** (0.0272)	-0.3173*** (0.0214)
<b>ETA Elasticity</b>	-0.0631*** (0.0060)	-0.0380*** (0.0059)	-0.0373*** (0.0055)	-0.0206*** (0.0048)	-0.0345*** (0.0061)
<b>PT Elasticity</b>	-0.5549*** (0.0353)	-0.6208*** (0.0636)	-0.4560*** (0.0356)	-0.4747*** (0.0430)	-0.5129*** (0.0347)
<b>VOT</b>	26.34*** (2.77)	17.19*** (3.04)	20.56*** (3.19)	13.14*** (3.11)	17.09*** (2.98)
<b>Control Avg. ETA</b>	3.51	2.92	3.13	2.55	3.72
<b>Control Avg. Price</b>	13.55	13.68	13.10	12.85	15.74
<b>Control Req. Rate</b>	0.667	0.592	0.620	0.634	0.618
<b>Controls</b>	x	x	x	x	x
<i>N</i>	491568	754771	581334	781610	487177
<i>R</i> <sup>2</sup>	0.079	0.062	0.076	0.077	0.057

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for user geohash5, region, local week of year, business user, airport session, and decile of user lifetime rides.

Table G.9

Second-stage regression results without always- and never-requesters, by time of day (weekends).

	11PM-6AM	6AM-10AM	10AM-4PM	4PM-7PM	7PM-11PM
ln(ETA)	-0.0284*** (0.0065)	-0.0262*** (0.0040)	-0.0246*** (0.0043)	-0.0194*** (0.0041)	-0.0136*** (0.0037)
ln(1 + PT)	-0.3554*** (0.0470)	-0.3831*** (0.0278)	-0.3455*** (0.0249)	-0.3647*** (0.0414)	-0.3068*** (0.0209)
<b>ETA Elasticity</b>	-0.0515*** (0.0117)	-0.0459*** (0.0070)	-0.0411*** (0.0071)	-0.0307*** (0.0065)	-0.0200*** (0.0054)
<b>PT Elasticity</b>	-0.6442*** (0.0852)	-0.6706*** (0.0487)	-0.5764*** (0.0416)	-0.5784*** (0.0656)	-0.4520*** (0.0308)
<b>VOT</b>	16.99*** (4.23)	17.53*** (2.80)	18.35*** (3.26)	16.01*** (3.59)	13.88*** (3.70)
<b>Control Avg. ETA</b>	4.10	3.07	3.10	2.56	2.74
<b>Control Avg. Price</b>	14.51	13.10	13.32	12.84	14.35
<b>Control Req. Rate</b>	0.556	0.575	0.603	0.633	0.679
<b>Controls</b>	x	x	x	x	x
<i>N</i>	120709	363839	244162	335387	389333
<i>R</i> <sup>2</sup>	0.077	0.076	0.083	0.082	0.058

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for user geohash5, region, local week of year, business user, airport session, and decile of user lifetime rides.

Table G.10

Second stage regression results, with controls for lateness of previous ride, excluding always-/never-requesters.

	With controls for lateness of last experience			
	No control	$(ATA - ETA)$	$\mathbb{1}_{late}(ATA - ETA)$	$\mathbb{1}_{late} \log(ATA - ETA)$
ln(ETA)	-0.023*** (0.002)	-0.023*** (0.002)	-0.023*** (0.002)	-0.023*** (0.002)
ln(1 + PT)	-0.324*** (0.016)	-0.324*** (0.016)	-0.324*** (0.016)	-0.324*** (0.016)
Lateness	—	-0.0001*** (0.0000)	-0.0001*** (0.0000)	-0.0035*** (0.0003)
ETA Elasticity	-0.034*** (0.003)	-0.034*** (0.003)	-0.034*** (0.003)	-0.034*** (0.003)
PT Elasticity	-0.481*** (0.024)	-0.481*** (0.024)	-0.481*** (0.024)	-0.481*** (0.024)
VOT	19.46*** (1.83)	19.46*** (1.83)	19.45*** (1.83)	19.18*** (1.83)
Control Avg. ETA	2.93	2.93	2.93	2.93
Control Avg. Price	13.35	13.35	13.35	13.35
Control Req. Rate	0.676	0.676	0.676	0.676
Controls	x	x	x	x
$N$	2874921	2874921	2874921	2874921
$R^2$	0.062	0.062	0.062	0.062

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Always- (never-) requesters are passengers who have a request rate of 100% (0%) during experimental period. Including controls for user geohash5, region, local week of year, business user, airport session, and decile of user lifetime rides. The results in this table are from a regression of the form:  $Request = \beta_0 + \beta_1 \ln(ETA) + \beta_2 \ln(1 + PT) + \beta_3 Lateness + \sum_k \gamma_k X_k$ , where the measure of lateness is from the most recent trip that the rider took prior to that session and  $X$  are the controls. The measures of lateness that we examine include (1) the difference between ATA and ETA for the last ride (in seconds), (2) the difference between ATA and ETA for the last ride if the arrival was late, and (3) the logged difference between ATA and ETA if the arrival was late. Arrivals were tagged as late if  $ATA - ETA > 0$ . We subset to sessions where the passenger had prior ride experience; this consists of 62% of the full sample.

## H External Validity

One concern with our elasticity and VOT estimates is that they are based on a particular subpopulation—Lyft passengers in the sampled cities—and hence may not generalize to the broader population.

To assess the degree of this external validity problem, we use person-level data from the 2017 National Household Travel Survey (Federal Highway Administration, 2017). This survey reports person-level data on a number of demographic characteristics, including race, gender, income, and education; person-level weights, which can be used to extrapolate the survey results to the full U.S. population; and detailed information on travel patterns, including the answer to this question about use of rideshare services: *“In the past 30 days, how many times have you purchased a ride with a smartphone rideshare app (e.g. Uber, Lyft, Sidecar)?”*

We define “Rideshare Users” to be all persons in the survey who reported a positive number to this question. In Figure H.1, we subset the NHTS data to persons who live in core-based statistical areas (CBSAs) corresponding to the eight regions in our first experiment, and compare “Rideshare Users” to the general population in the survey along a number of demographic dimensions. Throughout this analysis, we use the person-level weights provided by the NHTS to account for sample selection of the survey itself.

We note from the graphs that while rideshare users have similar race and gender distributions to the full population, they tend to skew toward the upper end of the income and education distributions, bunch up in the 20–40 years old portion of the age distribution, and skew toward the lower end of the household size distribution. Rideshare users are also more likely to reside in urban areas.

This evidence suggests that the population of rideshare users does differ systematically from the general population, implying that our value of time and elasticity estimates may not readily generalize to non-rideshare users.

To measure the extent of the bias resulting from this selection, we consider reweighting our data by the inverse of each passenger’s propensity to use rideshare. Specifically, we proceed as follows:

1. Use the NHTS person-level data to estimate a probit model of an individual’s propensity to use rideshare in the regions in our first experiment, as a function of their CBSA, income level, and home Census tract population density.<sup>67</sup>
2. For each user in the first experiment, we impute a home location (either a latitude-longitude pair or a ZIP Code Tabulation Area), and use this home location to estimate their CBSA, Census tract, and household income.<sup>68</sup>

---

<sup>67</sup>The NHTS person-level weights are used in the estimation of the probit model.

<sup>68</sup>Passenger home locations are inferred through a combination of billing addresses, in-app passenger-set shortcuts, and frequent pickup and destination locations. Income is imputed as the median household income in the home Census block group (when precise home coordinates are available) or ZCTA (when only a home ZIP is available) using data from the 2017 American Community Survey (ACS). ZIP codes were mapped to CBSAs and Census tracts using the HUD-USPS ZIP Code Crosswalk data.

3. Using the model estimated in Step 1 and the demographic features imputed in Step 2, we calculate the propensity to use rideshare of each user in our first experiment.
4. We run our main specification, using inverse propensity weights based on the propensities computed in Step 3 and subsetting to each user’s first session in the experiment (to account for the fact our weights are at the user-level rather than the session level).

Table H.1 shows the results, both with and without the inverse probability weights. Some users were dropped, as median income data for their modal Census tracts was unavailable.

Table H.1

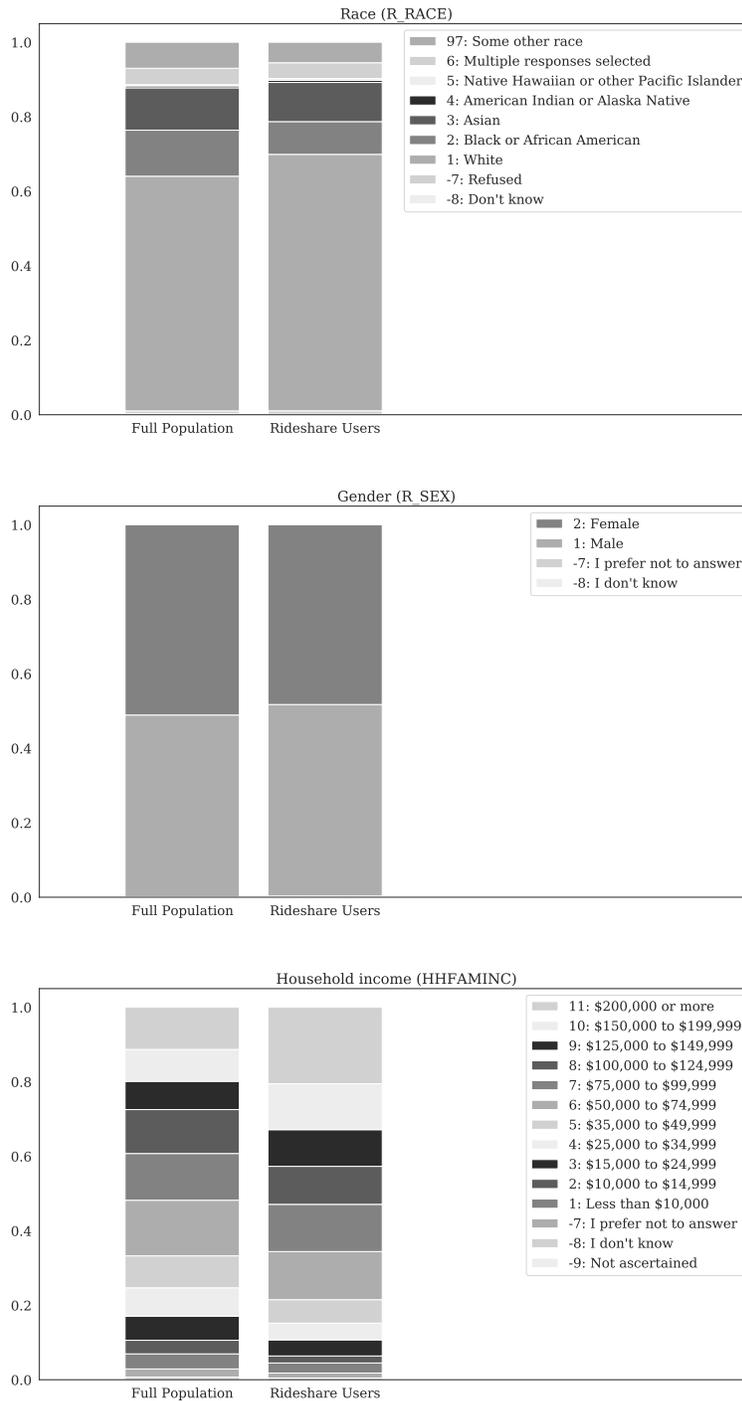
2SLS regression results for each passenger’s first session in the experiment, both with and without inverse propensity weighting by propensity to use rideshare services.

	Unweighted	Weighted
ln(ETA)	-0.0264*** (0.0027)	-0.0230*** (0.0046)
ln(1 + PT)	-0.3439*** (0.0180)	-0.3098*** (0.0353)
ETA Elasticity	-0.0447*** (0.0046)	-0.0390*** (0.0079)
PT Elasticity	-0.5833*** (0.0305)	-0.5253*** (0.0600)
VOT	23.39*** (2.50)	22.84*** (4.89)
Control Avg. ETA	3.35	3.53
Control Avg. Price	17.05	18.12
Control Req. Rate	0.593	0.594
Controls	x	x
$N$	694703	694703
$R^2$	0.070	0.073

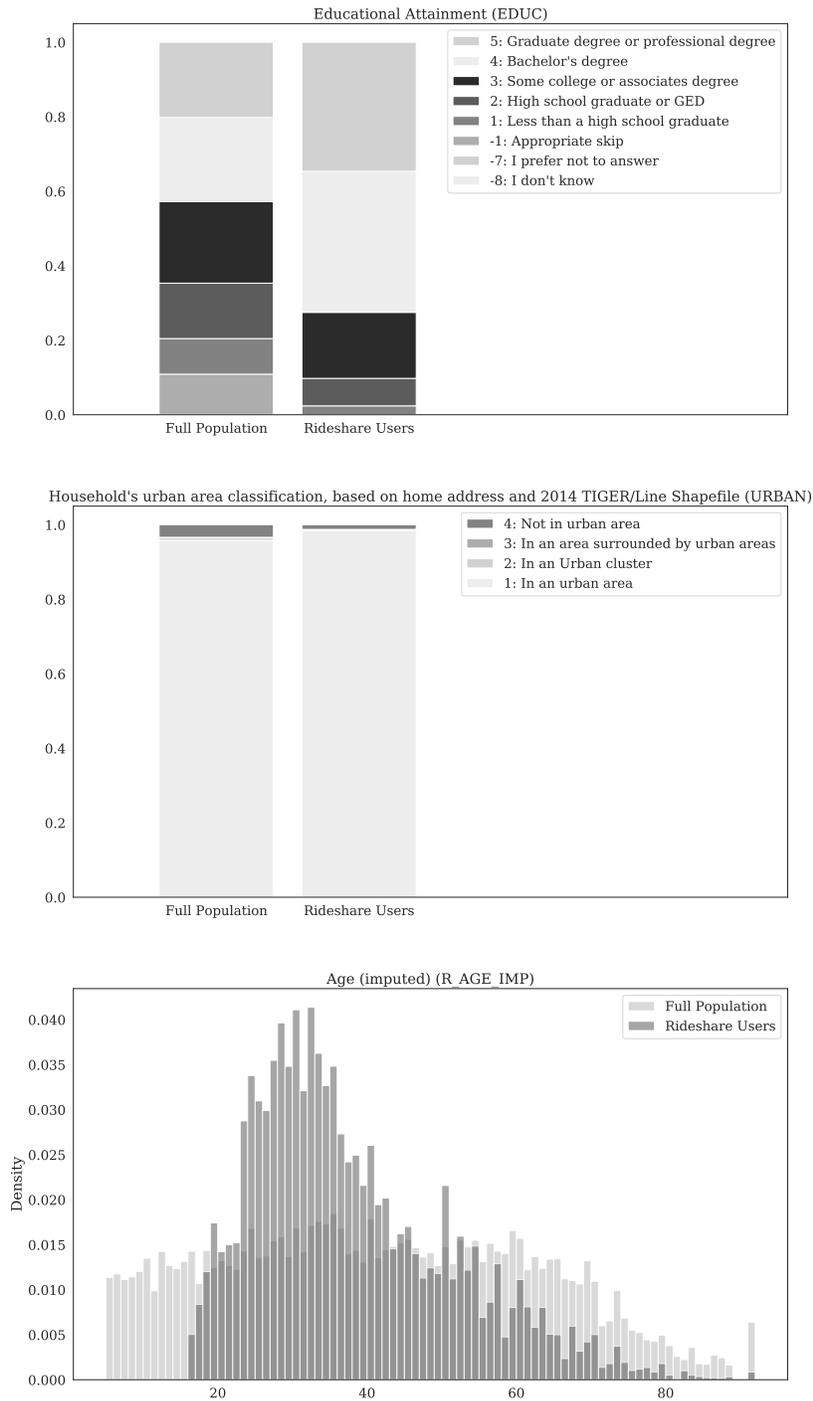
*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

The inverse propensity weighting decreases both elasticity estimates. At the same time, in the reweighted sample, control average ETAs are slightly higher and control average prices slightly lower. These effects together result in an estimated VOT about 2% smaller than that which is estimated without weighting. This result suggests that our estimates are not significantly biased by the selective nature of the subpopulation of rideshare users. Some caveats must be kept in mind: our demographic features are imputed rather than actual, and our propensity score model

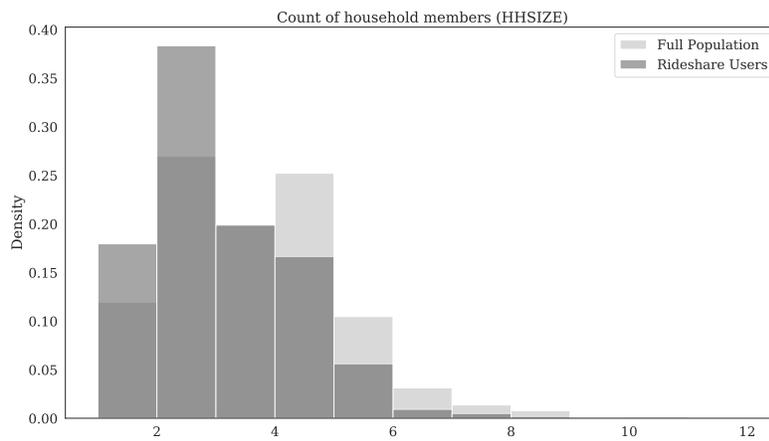
estimates the propensity to use any rideshare services within a month, which may differ from the propensity to use Lyft over a ten-week period.



**Figure H.1**  
 Comparison of demographic characteristics of rideshare users and the general population in the regions sampled for experiment 1, based on data from the National Household Travel Survey (Federal Highway Administration, 2017).



**Figure H.1**  
 Comparison of demographic characteristics of rideshare users and the general population in the regions sampled for experiment 1, based on data from the National Household Travel Survey (Federal Highway Administration, 2017) (continued).



**Figure H.1**  
 Comparison of demographic characteristics of rideshare users and the general population in the regions sampled for experiment 1, based on data from the National Household Travel Survey (Federal Highway Administration, 2017) (continued).

# I Correcting for User Selection into Ride Contexts

The patterns of heterogeneity we document across contexts do not take into account user self-selection into these contexts. As a consequence, though our heterogeneity analysis suggests, for example, that the VOT is higher in passenger sessions occurring during commuting times than other times of the week, it does not let us say whether this context “causes” higher VOTs—it may instead be the case that passengers with higher VOTs are more likely to have sessions during commuting times.

The purpose of this analysis is to separate contextual and selection effects in the observed heterogeneity, by weighting each user  $i$ ’s sessions in context  $x$  by the inverse of an estimate of user  $i$ ’s propensity to have a session in context  $x$ ,  $\hat{p}_{i,x}$ .

We can estimate these propensities using pre-experiment data as the observed fraction of user  $i$ ’s sessions that occur in context  $x$ . The propensity is estimated using  $n_{i,x}$ , the number of user  $i$ ’s pre-experiment sessions that occurred in context  $x$ :

$$\hat{p}_{x,i} = \frac{n_{x,i}}{\sum_{x' \in X} n_{x',i}}. \quad (29)$$

These estimates have high variances. The estimated propensities often equal 0 (in which case their inverses are undefined), and do not exist for users with no pre-experiment sessions.

To address these issues, we instead adopt an empirical Bayes estimation strategy. For each range of contexts  $X$  (for example, the different days of the week, or {downtown, non-downtown}), we assume that the set of vectors  $\{(p_{i,x})_{x \in X}\}$  is composed of independent draws from a Dirichlet distribution with parameter vector  $\alpha_X$ .  $\alpha_X$  can be estimated from the data. Conditional on  $\alpha_X$ , we note that  $\{(n_{x,i})_{x \in X}\}$  are independent draws from the Dirichlet-multinomial distribution (the multi-category generalization of the beta-binomial distribution), with joint density proportional to

$$\prod_i \left( \frac{\Gamma(\sum_x \alpha_x)}{\Gamma(\sum_x n_{x,i} + \alpha_x)} \prod_x \frac{\Gamma(n_{x,i} + \alpha_x)}{\Gamma(\alpha_x)} \right) \quad (30)$$

(Mosimann, 1962). From (30),  $\alpha_X$  can be estimated by maximum likelihood. We then take the maximum a posteriori estimate of each vector  $(p_{i,x})_{x \in X}$  based on the data  $(n_{i,x})_{x \in X}$  and the prior Dirichlet( $\hat{\alpha}_X$ ). The resulting estimates are

$$\hat{p}_{x,i} = \frac{n_{x,i} + \hat{\alpha}_x}{\sum_{x'} n_{x',i} + \hat{\alpha}_{x'}}, \quad (31)$$

from which we see that the empirical Bayes approach amounts to shrinking the basic estimates  $n_{x,i} / \sum_{x'} n_{x',i}$  toward  $\hat{\alpha}_x / \sum_{x'} \hat{\alpha}_{x'}$ , where estimates for users with fewer pre-experiment observa-

tions are shrunk more.<sup>69</sup>

Tables I.1 through I.5 reproduce heterogeneity analyses for whether downtown, whether at an airport, day and time of week, and distance to public transit using the inverses of the empirical Bayes propensity estimates as observation weights. The non-downtown vs. downtown results do not show a higher VOT in downtown sessions, suggesting that the observed higher VOT in the unweighted data may be attributable to user selection. Results for non-airport vs. airport sessions are similar, though the airport estimates remain very imprecise due to the small sample size. In contrast, the results for day and time of week are similar to those found in the unweighted data. We find that the VOT is highest in the morning commute, suggesting that this result is not primarily due to user selection. Results using inverse propensity weights based on distance to transit bins are also similar to those observed in the unweighted data.

Table I.1

2SLS regression results by whether session is downtown, using empirical Bayes inverse propensity weights.

	Non-downtown	Downtown
ln(ETA)	-0.0397*** (0.0066)	-0.0233*** (0.0033)
ln(1 + PT)	-0.3874*** (0.0666)	-0.3425*** (0.0199)
ETA Elasticity	-0.0740*** (0.0125)	-0.0360*** (0.0049)
PT Elasticity	-0.7219*** (0.1259)	-0.5288*** (0.0300)
VOT	29.63*** (6.34)	24.17*** (3.47)
Control Avg. ETA	4.14	2.34
Control Avg. Price	19.96	13.83
Control Req. Rate	0.533	0.674
Controls	x	x
$N$	1986393	3190965
$R^2$	0.059	0.057

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

We compare these inverse-propensity-weighted estimates to those obtained from the Heckman (1979) two-step correction procedure. For each context  $x$  in the range of contexts  $X$ , we estimate

<sup>69</sup>For more details on empirical Bayes Dirichlet-multinomial estimation, see Maritz and Lwin (1989), section 4.5.

Table I.2

2SLS regression results by whether session is at an airport, using empirical Bayes inverse propensity weights.

	Non-airport	Airport
ln(ETA)	-0.0266*** (0.0018)	-0.0181 (0.0159)
ln(1 + PT)	-0.3673*** (0.0132)	-0.6019* (0.3244)
<b>ETA Elasticity</b>	-0.0431*** (0.0029)	-0.0301 (0.0264)
<b>PT Elasticity</b>	-0.5956*** (0.0214)	-1.0021* (0.5449)
<b>VOT</b>	18.85*** (1.35)	18.07 (21.06)
<b>Control Avg. ETA</b>	<b>3.09</b>	<b>3.08</b>
<b>Control Avg. Price</b>	<b>13.39</b>	<b>30.86</b>
<b>Control Req. Rate</b>	<b>0.620</b>	<b>0.606</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	<b>5048270</b>	<b>129088</b>
<i>R</i> <sup>2</sup>	<b>0.074</b>	<b>0.079</b>

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table I.3

2SLS regression results by day of week, using empirical Bayes inverse propensity weights.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
ln(ETA)	-0.0273*** (0.0032)	-0.0291*** (0.0032)	-0.0305*** (0.0032)	-0.0259*** (0.0031)	-0.0255*** (0.0029)	-0.0248*** (0.0028)	-0.0228*** (0.0029)
ln(1 + PT)	-0.3762*** (0.0283)	-0.4145*** (0.0318)	-0.4155*** (0.0314)	-0.3555*** (0.0221)	-0.3050*** (0.0150)	-0.3844*** (0.0204)	-0.3878*** (0.0189)
ETA Elasticity	-0.0458*** (0.0054)	-0.0474*** (0.0052)	-0.0493*** (0.0052)	-0.0428*** (0.0050)	-0.0409*** (0.0046)	-0.0393*** (0.0044)	-0.0381*** (0.0048)
PT Elasticity	-0.6305*** (0.0473)	-0.6742*** (0.0515)	-0.6720*** (0.0505)	-0.5872*** (0.0364)	-0.4898*** (0.0241)	-0.6095*** (0.0324)	-0.6475*** (0.0316)
VOT	19.25*** (2.54)	18.76*** (2.38)	20.46*** (2.48)	20.13*** (2.50)	21.38*** (2.44)	18.12*** (2.09)	15.90*** (2.07)
Control Avg. ETA	3.12	3.03	2.94	3.07	3.38	2.87	3.11
Control Avg. Price	13.79	13.49	13.67	14.13	14.40	13.45	14.00
Control Req. Rate	0.606	0.627	0.630	0.610	0.625	0.634	0.604
Controls	x	x	x	x	x	x	x
$N$	621203	632247	623344	722306	913007	902130	763121
$R^2$	0.078	0.073	0.073	0.069	0.064	0.076	0.086

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

a probit regression

$$\mathbb{P}\{\text{session } ij \text{ is in context } x | W_{ij}\} = \Phi(W_{ij}'\beta_x) \quad (32)$$

where the vector  $W_{ij}$  consists of a binary indicator of whether user  $i$  has any pre-experiment sessions; the number of user  $i$ 's pre-experiment sessions; and the fraction of user  $i$ 's pre-experiment sessions which occurred in context  $j$  (set to 0 for users with no pre-experiment sessions). In the 2SLS regression on the subsample of sessions in context  $x$ , we then include the inverse Mills ratio (IMR) based on the probit (32) as a regressor in the first and second stages.

The results of this procedure are shown in Tables I.6 through I.10. In almost all regressions, the estimated coefficient on the IMR is statistically significant, but the estimated elasticities and VOTs are little changed versus the uncorrected results.

Table I.4

2SLS regression results by time of week, using empirical Bayes inverse propensity weights.

Weekdays					
	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0471*** (0.0043)	−0.0267*** (0.0034)	−0.0270*** (0.0033)	−0.0151*** (0.0030)	−0.0246*** (0.0038)
ln(1 + PT)	−0.3907*** (0.0265)	−0.3962*** (0.0346)	−0.3302*** (0.0223)	−0.3449*** (0.0274)	−0.3165*** (0.0200)
ETA Elasticity	−0.0767*** (0.0067)	−0.0470*** (0.0059)	−0.0450*** (0.0055)	−0.0244*** (0.0048)	−0.0405*** (0.0062)
PT Elasticity	−0.6361*** (0.0420)	−0.6969*** (0.0603)	−0.5519*** (0.0370)	−0.5558*** (0.0439)	−0.5202*** (0.0327)
VOT	29.23*** (3.02)	19.62*** (2.86)	20.78*** (2.72)	13.08*** (2.63)	19.93*** (3.07)
Control Avg. ETA	3.60	2.92	3.18	2.65	3.83
Control Avg. Price	14.53	14.15	13.48	13.14	16.34
Control Req. Rate	0.662	0.587	0.614	0.631	0.619
Controls	x	x	x	x	x
<i>N</i>	545313	859760	659754	888423	558857
<i>R</i> <sup>2</sup>	0.066	0.063	0.077	0.081	0.060
Weekends					
	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0283*** (0.0074)	−0.0310*** (0.0041)	−0.0323*** (0.0045)	−0.0229*** (0.0042)	−0.0145*** (0.0040)
ln(1 + PT)	−0.3670*** (0.0489)	−0.4117*** (0.0289)	−0.3665*** (0.0262)	−0.4302*** (0.0423)	−0.3397*** (0.0229)
ETA Elasticity	−0.0514*** (0.0135)	−0.0546*** (0.0072)	−0.0542*** (0.0076)	−0.0365*** (0.0067)	−0.0216*** (0.0059)
PT Elasticity	−0.6672*** (0.0893)	−0.7258*** (0.0509)	−0.6145*** (0.0441)	−0.6855*** (0.0674)	−0.5076*** (0.0339)
VOT	17.27*** (4.82)	19.52*** (2.75)	22.83*** (3.33)	16.01*** (3.11)	13.28*** (3.63)
Control Avg. ETA	4.01	3.08	3.12	2.58	2.78
Control Avg. Price	14.99	13.33	13.45	12.93	14.47
Control Req. Rate	0.557	0.574	0.600	0.633	0.683
Controls	x	x	x	x	x
<i>N</i>	135429	412620	280795	386487	449920
<i>R</i> <sup>2</sup>	0.076	0.082	0.093	0.092	0.063

Notes: \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1. Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table I.5

2SLS regression results by distance to nearest public transit, using empirical Bayes inverse propensity weights.

	Under 50m	50 to 200m	200 to 800m	Over 800m
ln(ETA)	-0.0275*** (0.0032)	-0.0246*** (0.0022)	-0.0285*** (0.0037)	-0.0282** (0.0140)
ln(1 + PT)	-0.3299*** (0.0207)	-0.3445*** (0.0161)	-0.4143*** (0.0319)	-0.4957*** (0.1585)
ETA Elasticity	-0.0412*** (0.0047)	-0.0391*** (0.0035)	-0.0499*** (0.0067)	-0.0577** (0.0291)
PT Elasticity	-0.4940*** (0.0306)	-0.5476*** (0.0255)	-0.7261*** (0.0569)	-1.0129*** (0.3290)
VOT	25.03*** (3.02)	20.07*** (1.92)	19.87*** (2.80)	14.42* (7.94)
Control Avg. ETA	2.58	2.85	3.43	5.24
Control Avg. Price	12.90	13.35	16.54	22.11
Control Req. Rate	0.686	0.638	0.560	0.487
Controls	x	x	x	x
$N$	1054335	2554328	1269849	298846
$R^2$	0.062	0.067	0.061	0.101

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geo-hash5, business user, airport, and decile of pre-experiment lifetime rides.

Table I.6

2SLS regression results by whether session is downtown, using Heckman's two-step correction.

	Non-downtown	Downtown
ln(ETA)	-0.0317*** (0.0028)	-0.0231*** (0.0021)
ln(1 + PT)	-0.4025*** (0.0303)	-0.3520*** (0.0128)
IMR	-0.0285*** (0.0014)	-0.0079*** (0.0014)
ETA Elasticity	-0.0599*** (0.0054)	-0.0344*** (0.0031)
PT Elasticity	-0.7612*** (0.0574)	-0.5241*** (0.0191)
VOT	17.94*** (1.97)	21.65*** (1.99)
Control Avg. ETA	4.36	2.28
Control Avg. Price	16.57	12.54
Control Req. Rate	0.533	0.674
Controls	x	x
$N$	1986393	3190965
$R^2$	0.049	0.059

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table I.7

2SLS regression results by whether session is at an airport, using Heckman's two-step correction.

	Non-airport	Airport
ln(ETA)	-0.0266*** (0.0018)	-0.0135 (0.0094)
ln(1 + PT)	-0.3673*** (0.0132)	-0.3336*** (0.0924)
IMR	0.0077 (0.0103)	-0.0800*** (0.0274)
ETA Elasticity	-0.0431*** (0.0029)	-0.0223 (0.0155)
PT Elasticity	-0.5951*** (0.0214)	-0.5514*** (0.1525)
VOT	18.84*** (1.35)	26.15 (18.24)
Control Avg. ETA	3.09	2.92
Control Avg. Price	13.37	31.40
Control Req. Rate	0.620	0.606
Controls	x	x
$N$	5048270	129088
$R^2$	0.074	0.082

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1+PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

**Table I.8**  
2SLS regression results by day of week, using Heckman's two-step correction.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
ln(ETA)	-0.0288*** (0.0031)	-0.0285*** (0.0031)	-0.0282*** (0.0031)	-0.0251*** (0.0030)	-0.0245*** (0.0028)	-0.0249*** (0.0026)	-0.0244*** (0.0028)
ln(1 + PT)	-0.3800*** (0.0277)	-0.4235*** (0.0305)	-0.4050*** (0.0300)	-0.3559*** (0.0214)	-0.2948*** (0.0145)	-0.3763*** (0.0193)	-0.3834*** (0.0180)
IMR	-0.2625*** (0.0172)	-0.2370*** (0.0151)	-0.3020*** (0.0169)	-0.0990*** (0.0281)	0.3593*** (0.0262)	-0.0511*** (0.0066)	-0.1208*** (0.0092)
ETA Elasticity	-0.0478*** (0.0052)	-0.0457*** (0.0050)	-0.0451*** (0.0050)	-0.0413*** (0.0049)	-0.0393*** (0.0045)	-0.0395*** (0.0041)	-0.0407*** (0.0046)
PT Elasticity	-0.6315*** (0.0461)	-0.6806*** (0.0491)	-0.6473*** (0.0480)	-0.5850*** (0.0352)	-0.4728*** (0.0233)	-0.5957*** (0.0306)	-0.6395*** (0.0300)
VOT	19.87*** (2.45)	17.82*** (2.21)	19.31*** (2.40)	19.43*** (2.41)	21.23*** (2.45)	18.73*** (2.04)	17.25*** (2.01)
Control Avg. ETA	3.13	3.03	2.93	3.07	3.38	2.86	3.12
Control Avg. Price	13.70	13.38	13.55	14.08	14.41	13.50	14.07
Control Req. Rate	0.606	0.627	0.630	0.610	0.625	0.634	0.604
Controls	x	x	x	x	x	x	x
<i>N</i>	621203	632247	623344	722306	913007	902130	763121
<i>R</i> <sup>2</sup>	0.082	0.078	0.078	0.071	0.065	0.077	0.086

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table I.9  
2SLS regression results by time of week, using Heckman's two-step correction.

Weekdays					
	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0447*** (0.0037)	−0.0266*** (0.0032)	−0.0281*** (0.0031)	−0.0152*** (0.0029)	−0.0246*** (0.0035)
ln(1 + PT)	−0.3963*** (0.0220)	−0.4128*** (0.0348)	−0.3171*** (0.0206)	−0.3400*** (0.0255)	−0.3363*** (0.0192)
IMR	−0.1783*** (0.0034)	−0.2269*** (0.0045)	−0.2383*** (0.0072)	−0.1498*** (0.0087)	−0.1351*** (0.0056)
ETA Elasticity	−0.0680*** (0.0056)	−0.0457*** (0.0055)	−0.0461*** (0.0052)	−0.0241*** (0.0045)	−0.0398*** (0.0056)
PT Elasticity	−0.6033*** (0.0336)	−0.7094*** (0.0598)	−0.5198*** (0.0338)	−0.5401*** (0.0405)	−0.5434*** (0.0311)
VOT	26.23*** (2.39)	18.27*** (2.56)	22.42*** (2.70)	13.42*** (2.58)	18.55*** (2.61)
Control Avg. ETA	3.54	2.95	3.16	2.60	3.81
Control Avg. Price	13.72	13.93	13.33	13.04	16.07
Control Req. Rate	0.662	0.587	0.614	0.631	0.619
Controls	x	x	x	x	x
<i>N</i>	545313	859760	659754	888423	558857
<i>R</i> <sup>2</sup>	0.094	0.075	0.086	0.086	0.064
Weekends					
	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0304*** (0.0060)	−0.0304*** (0.0037)	−0.0285*** (0.0040)	−0.0211*** (0.0038)	−0.0163*** (0.0034)
ln(1 + PT)	−0.3652*** (0.0444)	−0.4145*** (0.0264)	−0.3660*** (0.0234)	−0.4220*** (0.0389)	−0.3431*** (0.0194)
IMR	−0.2326*** (0.0130)	−0.2172*** (0.0131)	−0.2204*** (0.0174)	−0.1647*** (0.0114)	−0.0913*** (0.0039)
ETA Elasticity	−0.0551*** (0.0109)	−0.0534*** (0.0066)	−0.0478*** (0.0067)	−0.0335*** (0.0061)	−0.0239*** (0.0050)
PT Elasticity	−0.6614*** (0.0805)	−0.7286*** (0.0465)	−0.6150*** (0.0393)	−0.6697*** (0.0617)	−0.5025*** (0.0284)
VOT	17.91*** (3.95)	18.95*** (2.49)	20.18*** (2.92)	15.07*** (2.87)	14.99*** (3.10)
Control Avg. ETA	4.13	3.09	3.14	2.59	2.76
Control Avg. Price	14.79	13.32	13.59	13.01	14.54
Control Req. Rate	0.557	0.574	0.600	0.633	0.683
Controls	x	x	x	x	x
<i>N</i>	135429	412620	280795	386487	449920
<i>R</i> <sup>2</sup>	0.081	0.083	0.092	0.092	0.064

Notes: \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1. Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

Table I.10

2SLS regression results by distance to nearest public transit, using Heckman's two-step correction.

	Under 50m	50 to 200m	200 to 800m	Over 800m
ln(ETA)	-0.0270*** (0.0028)	-0.0250*** (0.0022)	-0.0282*** (0.0032)	-0.0278*** (0.0066)
ln(1 + PT)	-0.3382*** (0.0174)	-0.3359*** (0.0154)	-0.4456*** (0.0274)	-0.5687*** (0.0777)
IMR	0.0148*** (0.0029)	0.0242*** (0.0023)	0.0162*** (0.0021)	-0.0161*** (0.0024)
ETA Elasticity	-0.0395*** (0.0041)	-0.0393*** (0.0034)	-0.0506*** (0.0057)	-0.0575*** (0.0136)
PT Elasticity	-0.4953*** (0.0256)	-0.5286*** (0.0242)	-0.8015*** (0.0493)	-1.1733*** (0.1603)
VOT	23.91*** (2.56)	20.70*** (1.91)	16.95*** (2.03)	10.76*** (2.78)
Control Avg. ETA	2.47	2.82	3.60	5.29
Control Avg. Price	12.34	13.07	16.08	19.39
Control Req. Rate	0.686	0.638	0.560	0.487
Controls	x	x	x	x
$N$	1054335	2554328	1269849	298846
$R^2$	0.063	0.071	0.058	0.060

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) and ln(1 + PT) instrumented by experimental group indicators. Value of time expressed in 2015 US dollars per hour. Controls include local week of year, local hour of week, user geo-hash5, business user, airport, and decile of pre-experiment lifetime rides.

## J Reweighting Elasticity Estimates

In inspecting our results on heterogeneity of time elasticities, one may note that the control average ETA often varies considerably between subsamples. In light of the evidence from the second experiment suggesting that ETA elasticities vary over the demand curve, this observation calls into question whether our heterogeneity results are due to differences in the demand curve between subsamples, or whether they are due to us estimating elasticities at different points in different samples.

To see the issue formally, consider a simplified version of our main model, in which demand  $D_i$  in session  $i$  is a function of the (logged) waiting time  $T_i \geq 0$ , session and user characteristics  $X_i$ , and an unobserved shock  $\varepsilon_i$ :

$$D_i = D_i(T_i, X_i, \varepsilon_i). \quad (33)$$

Suppose further that  $z_i$  is a binary instrument for  $T_i$ , satisfying the assumptions of independence ( $z_i$  is independent of  $(T_i(X_i, 1), T_i(X_i, 0))$ , conditional on  $X_i$ ), exclusion ( $D_i(T, X, z) = D_i(T, X, z')$  for all  $z, z'$ ), and strict monotonicity ( $T_i(X_i, 1) > T_i(X_i, 0)$ ). Now, consider restricting the sample to observations  $i$  for which  $X_i = x$  and running an IV regression of  $D_i$  on  $T_i$  using  $z_i$  as an instrument. The resulting coefficient on  $T_i$  will be an estimate of

$$\beta_x = \frac{\mathbb{E}[D_i(T_i(1), X_i, 1) - D_i(T_i(0), X_i, 0) | X_i = x]}{\mathbb{E}[T_i(1) - T_i(0) | X_i = x]} \quad (34)$$

$$= \int_0^\infty \mathbb{E} \left[ \frac{\partial D_i}{\partial T}(T) | T_i(0) < T < T_i(1), X_i = x \right] \omega(T|x) dT \quad (35)$$

where

$$\omega(T|x) \propto \mathbb{P}[T_i(0) < T < T_i(1) | X_i = x],$$

and  $\omega(T|x)$  is normalized to integrate to 1. The proof is the same as that of Theorem 1 in [Angrist et al. \(2000\)](#).

The above result shows that for two values of  $X$ , say  $x$  and  $x'$ , separate IV regressions for the subsamples of observations with  $X_i = x$  and  $X_i = x'$  will estimate quantities that may differ for two reasons:

1.  $\mathbb{E} \left[ \frac{\partial D_i}{\partial T}(T) | T_i(0) < T < T_i(1), X_i = x \right]$  may differ from  $\mathbb{E} \left[ \frac{\partial D_i}{\partial T}(T) | T_i(0) < T < T_i(1), X_i = x' \right]$  for some fixed  $T$ ; or
2.  $\omega(\cdot, x)$  may differ from  $\omega(\cdot, x')$ .

Differences of the first kind are economically interesting, as they indicate that the average slope of the demand curve at some fixed point differs between the two samples. Differences of the second

kind are nuisances, as they are caused by our semi-elasticity estimates for the two subsamples being measured at different points.

Note that  $\omega(\cdot|x)$  is determined by the distribution  $(T_i(0), T_i(1))|X_i = x$ . Hence, if  $(T_i(0), T_i(1))|X_i = x \sim (T_i(0), T_i(1))|X_i = x'$ , we would have  $\omega(\cdot|x) = \omega(\cdot|x')$ , and any differences between  $\beta_x$  and  $\beta_{x'}$  would be of the first kind.

We may attempt to set  $(T_i(0), T_i(1))|X_i = x \sim (T_i(0), T_i(1))|X_i = x'$  by reweighting each subsample. If such weights can be found, and can be chosen independently of  $z_i$ , we may then run weighted IV regressions on each subsample to estimate semi-elasticities which represent weighted average derivatives over the same sections of the demand curve, with the same weights, and can therefore be more readily compared.<sup>70</sup>

We attempt such reweighting for the second experiment, in which we can observe what a session's ETA quote would have been under each treatment level. To find a reweighting scheme that (approximately) equates the joint distributions of potential ETAs, we employ the maximum entropy rebalancing idea of [Hainmueller \(2012\)](#). This entails solving a smooth, convex, constrained optimization problem to find the maximum entropy weight vector  $w$  which sets certain moments in the data equal to pre-specified target moments. For our application, we use moments on the following variables:

- the logged counterfactual ETA for each treatment level, and the squares and cross-products of these values;
- indicators of each time category of the week;
- indicators of precipitation type;
- an indicator of whether the session is downtown;
- an indicator of whether the user is a business user;
- indicators for distance to nearest public transit;
- indicators for each region; and
- log of the price multiplier and its square.

For each variable, the target moment is the moment in the full data sample. Matching moments of logged counterfactual ETA for each treatment, as well as squares and cross-products of these, is intended to approximately balance the conditional joint distributions of counterfactual ETAs in each subsample. We also add various moment conditions on control variables to protect against the possibility that reweighting to balance counterfactual ETA distributions causes the samples to

---

<sup>70</sup>A similar argument shows that the semi-elasticity estimates from 2SLS regressions with multiple binary instruments can also be compared across subsamples so long as the conditional joint distributions of potential ETAs for each value of the instrument vector are the same between the two subsamples:  $(T_i(z_0), \dots, T_i(z_k))|X_i = x \sim (T_i(z_0), \dots, T_i(z_k))|X_i = x'$ .

become unbalanced on other observables.<sup>71</sup> We focusing on a particular heterogeneity dimension, we drop the associated moment condition (e.g., when comparing time elasticities across regions, we do not reweight by region.)

Table J.1 gives the entropy-balance-reweighted 2SLS results by region. The results are quite similar to those found without reweighting: we still find New York City and Washington, D.C. to have the largest ETA elasticities and Miami to have the smallest ETA elasticity, suggesting that these regional variations in ETA elasticities reflect true differences in the underlying demand curves, and not just differences in prevailing ETA levels. Our observed results comparing ETA elasticities at different times of the week are also robust to reweighting (Tables J.2 and J.3).

Table J.1  
Reweighted 2SLS results by region.

	San Francisco	New York City	Chicago	D.C.	Miami	New Jersey	Boston	Philadelphia	Atlanta	Los Angeles
ln(ETA)	-0.0247*** (0.0021)	-0.0463*** (0.0014)	-0.0249*** (0.0014)	-0.0306*** (0.0015)	-0.0165*** (0.0026)	-0.0182*** (0.0023)	-0.0271*** (0.0021)	-0.0194*** (0.0023)	-0.0101*** (0.0033)	-0.0219*** (0.0015)
ln(1 + PT)	-0.2379*** (0.0047)	-0.3478*** (0.0028)	-0.2826*** (0.0027)	-0.2875*** (0.0023)	-0.1567*** (0.0081)	-0.3065*** (0.0039)	-0.3392*** (0.0026)	-0.2526*** (0.0041)	-0.1809*** (0.0078)	-0.2434*** (0.0041)
ETA Elasticity	-0.0361*** (0.0030)	-0.0882*** (0.0027)	-0.0406*** (0.0022)	-0.0491*** (0.0025)	-0.0257*** (0.0040)	-0.0319*** (0.0042)	-0.0440*** (0.0035)	-0.0331*** (0.0039)	-0.0162*** (0.0055)	-0.0345*** (0.0023)
Control Avg. ETA	3.37	3.41	3.38	3.39	3.38	3.41	3.38	3.40	3.39	3.40
Control Req. Rate	0.690	0.538	0.621	0.631	0.648	0.576	0.622	0.592	0.625	0.640
Controls	x	x	x	x	x	x	x	x	x	x
N	1325977	1261730	1101478	894309	798597	631453	677806	473281	487427	1842581
R <sup>2</sup>	0.076	0.068	0.071	0.055	0.049	0.061	0.068	0.064	0.053	0.060

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

Table J.2  
Reweighted 2SLS results by time of day (weekdays).

	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	-0.0367*** (0.0012)	-0.0240*** (0.0010)	-0.0288*** (0.0013)	-0.0253*** (0.0012)	-0.0210*** (0.0016)
ln(1 + PT)	-0.3441*** (0.0019)	-0.2960*** (0.0024)	-0.3154*** (0.0023)	-0.2783*** (0.0027)	-0.2508*** (0.0030)
ETA Elasticity	-0.0558*** (0.0019)	-0.0400*** (0.0017)	-0.0467*** (0.0020)	-0.0422*** (0.0019)	-0.0338*** (0.0025)
Control Avg. ETA	3.39	3.39	3.38	3.39	3.38
Control Req. Rate	0.668	0.606	0.625	0.606	0.628
Controls	x	x	x	x	x
N	1196076	1795586	1207487	1447026	777861
R <sup>2</sup>	0.084	0.074	0.077	0.092	0.077

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

<sup>71</sup>It is, of course, still possible that the reweighting causes the samples to become unbalanced on unobservables.

Table J.3  
Reweighted 2SLS results by time of day (weekends).

	6–10 AM	10 AM–4 PM	4 PM–7 PM	7 PM–11 PM	11 PM–6 AM
ln(ETA)	−0.0293*** (0.0025)	−0.0263*** (0.0015)	−0.0258*** (0.0019)	−0.0218*** (0.0017)	−0.0198*** (0.0018)
ln(1 + PT)	−0.3135*** (0.0040)	−0.3109*** (0.0028)	−0.2980*** (0.0035)	−0.2557*** (0.0038)	−0.2282*** (0.0032)
ETA Elasticity	−0.0493*** (0.0044)	−0.0448*** (0.0025)	−0.0426*** (0.0032)	−0.0358*** (0.0028)	−0.0305*** (0.0028)
Control Avg. ETA	3.40	3.40	3.39	3.39	3.38
Control Req. Rate	0.602	0.594	0.614	0.616	0.656
Controls	x	x	x	x	x
$N$	314065	886668	498999	678722	692149
$R^2$	0.073	0.072	0.077	0.085	0.065

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

Table J.4 gives reweighted results by precipitation type. Here, the difference between elasticities is no longer statistically significant.

Table J.5 gives reweighted results by whether the session is downtown. Here, the result reverses relative to the unweighted results, and we find a significantly larger ETA elasticity for downtown sessions. This suggests that the counterintuitive unweighted result of non-downtown elasticities being larger was driven by ETAs being larger in non-downtown sessions, and not by non-downtown sessions being more responsive to changes in waiting time at the same base ETA level. Similarly, Table J.6 shows that the ETA elasticity is greater when passengers are closer to public transit; this result runs counter to the unweighted estimates but is consistent with economic intuition.

The validity of this method depends on the quality of the counterfactual data, and the assumption that treatment does not affect counterfactual outcomes. For some observations, the no or only incomplete counterfactual data is available; for other sessions, the counterfactual data has apparent “errors”: the reported “counterfactual” ETA for the treatment a session actually received differs from the actual ETA. Missing and incorrect counterfactuals affect about 2% of sessions, and are attributable to small technical errors in logging. In Table J.8, we show that whether counterfactual data is missing and the degree of the counterfactual are not significantly predicted by treatment status.

In Table J.9, we regress the reported counterfactuals for each treatment group on indicator variables of treatment received. Here we find statistically significant (though economically small) evidence that sessions which had their ETAs increased more show lower counterfactual ETAs

Table J.4  
Reweighted 2SLS results by precipitation type.

	None	Rain
ln(ETA)	-0.0268*** (0.0005)	-0.0244*** (0.0016)
ln(1 + PT)	-0.2852*** (0.0015)	-0.2909*** (0.0028)
<b>ETA Elasticity</b>	<b>-0.0435***</b> <b>(0.0008)</b>	<b>-0.0396***</b> <b>(0.0026)</b>
<b>Control Avg. ETA</b>	<b>3.39</b>	<b>3.38</b>
<b>Control Req. Rate</b>	<b>0.624</b>	<b>0.625</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	<b>7467167</b>	<b>2027472</b>
<i>R</i> <sup>2</sup>	<b>0.074</b>	<b>0.077</b>

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

Table J.5  
Reweighted 2SLS results by whether session downtown.

	Non-downtown	Downtown
ln(ETA)	-0.0171*** (0.0011)	-0.0377*** (0.0011)
ln(1 + PT)	-0.2658*** (0.0033)	-0.2899*** (0.0018)
<b>ETA Elasticity</b>	<b>-0.0288***</b> <b>(0.0019)</b>	<b>-0.0587***</b> <b>(0.0017)</b>
<b>Control Avg. ETA</b>	<b>3.39</b>	<b>3.41</b>
<b>Control Req. Rate</b>	<b>0.598</b>	<b>0.653</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	<b>4262346</b>	<b>4918765</b>
<i>R</i> <sup>2</sup>	<b>0.065</b>	<b>0.067</b>

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

**Table J.6**  
Reweighted 2SLS results by distance to public transit.

	Under 50m	50 to 200m	200 to 800m	Over 800m
ln(ETA)	-0.0340*** (0.0011)	-0.0261*** (0.0006)	-0.0221*** (0.0011)	-0.0014 (0.0116)
ln(1 + PT)	-0.2902*** (0.0018)	-0.2880*** (0.0011)	-0.2864*** (0.0026)	-0.2467*** (0.0240)
<b>ETA Elasticity</b>	-0.0532*** (0.0017)	-0.0420*** (0.0010)	-0.0370*** (0.0019)	-0.0025 (0.0215)
<b>Control Avg. ETA</b>	<b>3.40</b>	<b>3.40</b>	<b>3.39</b>	<b>3.34</b>
<b>Control Req. Rate</b>	<b>0.648</b>	<b>0.629</b>	<b>0.605</b>	<b>0.554</b>
<b>Controls</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>
<i>N</i>	1958132	4764641	2244268	527598
<i>R</i> <sup>2</sup>	0.069	0.072	0.076	0.095

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

**Table J.7**  
Reweighted 2SLS results by whether business user.

	Non-business	Business
ln(ETA)	-0.0258*** (0.0005)	-0.0339*** (0.0019)
ln(1 + PT)	-0.2882*** (0.0011)	-0.2787*** (0.0036)
<b>ETA Elasticity</b>	-0.0420*** (0.0007)	-0.0526*** (0.0028)
<b>Control Avg. ETA</b>	<b>3.39</b>	<b>3.39</b>
<b>Control Req. Rate</b>	<b>0.622</b>	<b>0.655</b>
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	8839169	655470
<i>R</i> <sup>2</sup>	0.073	0.087

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. ln(ETA) instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

Table J.8

Regressions of errors in counterfactual (CF) data on treatment indicators for experiment 2.

	CF Data Missing	CF Error	Squared CF Error
Plus 60+	0.0000 (0.0001)	-0.0000 (0.0002)	-0.0013 (0.0012)
Plus 150+	-0.0001 (0.0001)	-0.0001 (0.0002)	-0.0006 (0.0014)
Plus 240+	0.0002 (0.0001)	-0.0003 (0.0003)	0.0039** (0.0017)
Controls	x	x	x
$N$	9668820	9494639	9494639
$R^2$	0.168	0.002	0.007
$F$	0.9	0.5	2.8**

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

then control sessions. Since we know that the experimental treatments were assigned randomly, this effect may be caused by the following mechanism: in location-times subject to higher ETA treatments, fewer requests are made, resulting in more available drivers nearby and a lower reported counterfactual ETA. If this mechanism is occurring, the “counterfactuals” we observe are not truly representative of what ETAs would have been experienced under different treatment regimes.

This mechanism constitutes an interaction effect, but the estimates in Table J.9 suggest that such effects are small in magnitude, shifting ETAs by about four seconds at most.

Table J.9

Regressions of counterfactual ETAs (in minutes) for each treatment level on treatment indicators.

	CF Control	CF Plus 60	CF Plus 150	CF Plus 240
Plus 60+	-0.0303*** (0.0016)	-0.0295*** (0.0018)	-0.0332*** (0.0018)	-0.0357*** (0.0018)
Plus 150+	-0.0379*** (0.0019)	-0.0378*** (0.0022)	-0.0430*** (0.0021)	-0.0472*** (0.0021)
Plus 240+	-0.0499*** (0.0024)	-0.0523*** (0.0030)	-0.0539*** (0.0028)	-0.0649*** (0.0028)
Controls	x	x	x	x
$N$	9494639	9494639	9494639	9494639
$R^2$	0.466	0.567	0.557	0.543
$F$	272.9***	198.8***	255.1***	329.3***

Notes: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses.  $\ln(\text{ETA})$  instrumented by experimental treatment indicators. Controls include local hour of week and week of year, session geohash5, business user, and decile of pre-experiment lifetime rides.

The dependent variable for each column is the counterfactual ETA reported for a particular treatment level, while the independent variables are indicators of which treatment a session actually received.

## K Ride Types

As noted in the text, Lyft offers multiple ride types, while our analysis is not ride-type-specific. In particular, our main proxy for demand—the indicator of whether a session had a ride request—does not differentiate between ride types, and the last-in-session ETA used in our regressions is not for a fixed ride type, but for whatever ride type the passenger selected last.

We consider in this section whether the presence of ride type effects may bias our results. We first note that the experimental variation does induce some small but significant effect on a passenger’s consideration and choice of ride type. In Table K.1, we regress indicators of whether a session considered the Shared at any point on the experimental treatment indicators. We find small but statistically significant effects on whether a session considers the Shared mode; the individual point estimates suggest that high price treatments increase the probability of looking at Shared, low price treatments decrease the probability, and high ETA treatments leave it unchanged. An  $F$  test of the hypotheses that the coefficient on High ETA Normal Price is 0, that the coefficients on High ETA High Price and Normal ETA High Price are equal, and High ETA Low Price and Normal ETA Low price returns a  $p$ -value of 0.23.

Since the ETA variation does not significantly affect which ride types are considered, ride type effects should not bias our estimate of the effect of ETA. Such effects may, however, bias our price elasticity estimates: the base price of a ride is a component of the error term in our main model, and the price instruments may be correlated with this component through the effect on ride type. This correlation would invalidate the exogeneity of our price instruments, resulting in

Table K.1  
Effect of treatments on ride types considered.

	Considered Shared	Considered XL
High ETA High Price	0.009*** (0.003)	0.001 (0.001)
High ETA Normal Price	0.004** (0.002)	0.000 (0.000)
High ETA Low Price	-0.006*** (0.002)	0.000 (0.000)
Normal ETA High Price	0.010*** (0.002)	0.000 (0.001)
Normal ETA Low Price	-0.006*** (0.002)	-0.000 (0.000)
<b>Controls</b>	<b>x</b>	<b>x</b>
<i>N</i>	5177358	5177358
<i>R</i> <sup>2</sup>	0.293	0.012
<i>F</i>	13***	1

*Notes:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Clustered standard errors in parentheses. *F* test is of the null that all the coefficients on the instruments equal 0. Controls include local week of year, local hour of week, user geohash5, business user, airport, and decile of pre-experiment lifetime rides.

The dependent variables for the two columns are indicators of whether a session ever selected the Shared or XL ride types, respectively.

an underestimate of the price elasticity and an overestimate of the VOT.

We argue, however, that such bias is likely to be small. For rides completed by control passengers in our sample, the average Standard price is \$14.65, the average XL price is 11.06, and the average XL price is 28.22. The three types account for 70.7%, 27.9%, and 1.3% of rides, respectively. From the results in Table K.1, we see that the Normal ETA High Price treatment increase the probability of considering the Shared type by 1.0 percentage points. As not all passengers induced to look at the Shared mode necessarily switch to considering only that mode, this implies at most that Normal ETA High Price passengers have their probability of considering Standard lowered by 1.0 percentage points and their probability of considering Shared raised by 1.0 percentage points. This shift implies that the average price faced by such passengers is lowered from 13.83 (the average price paid by control passengers) to, at worst,

$$(0.707 - 0.01) \times 14.65 + (0.279 + 0.01) \times 11.06 + 0.013 \times 28.22 = 13.77,$$

a 0.43% decrease, due solely to the effect on ride choice. For comparison, the direct effect of the Normal ETA High Price treatment on the price, through the Prime Time multiplier, is around 5%, around twenty times larger.

## L Distribution of VOT

Rather than evaluating our VOT estimate at the full-sample average ETAs and prices, we can plug in individual ETA and price estimates for each session to obtain a full distribution of VOTs. By also including interaction terms in our main model, we may also plug in individual ETA and price semi-elasticities of demand.

We estimate the following equation with 2SLS:

$$Request = \beta_0 + \beta_1 \ln(ETA) + \ln(ETA) \times D'B_1 + \beta_2 \ln(1 + PT) + \ln(1 + PT) \times D'B_2 + (controls) + \varepsilon,$$

where  $D$  is a vector of dummy variables indicating dimensions. We include region, time category, precipitation type, bin of distance to nearest public transit, and binary indicators for business users, airports, and downtown. Our first-stage equations interact the experimental treatment indicators with these same dummy variables:

$$\begin{aligned} \ln(ETA) &= \gamma_0 + \sum_{j=1}^5 [\gamma_j(Tj) + (Tj)D'\Gamma_j] + (controls) + u \\ \ln(1 + PT) &= \gamma_0 + \sum_{j=1}^5 [\delta_j(Tj) + (Tj)D'\Delta_j] + (controls) + v. \end{aligned}$$

For each session, the relevant price and time semi-elasticities of demand are given from the estimates of the above equation; these will vary between sessions according to their different values of  $D$ .

To obtain estimates of  $ETA$  and  $(1 + PT)$  for each session, we first apply the exponential function to the fitted values of the first-stage equation. These will generally be biased estimates. We correct for this bias by multiplying by the correction factor of [Goldberger \(1968\)](#), which may be written as

$$F = {}_0F_1(df_{resid}/2, (df_{resid}/2)(\hat{\sigma}^2/2 - \widehat{Var}(\hat{\gamma}_0))).$$

Here  $df_{resid}$  is the residual degrees of freedom in the logged first-stage equation;  $\hat{\sigma}^2$  is the usual estimator of the residual variance;  $\widehat{Var}(\hat{\gamma}_0)$  is the standard estimator of the variance of the estimate of the intercept; and  ${}_0F_1$  is the confluent hypergeometric function

$${}_0F_1(v, z) = \sum_{k=0}^{\infty} \frac{z^k}{(v)_k k!}$$

where  $(v)_k$  is the Pochhammer symbol  $(v)_k = \frac{\Gamma(v+n)}{\Gamma(v)}$  and  $\Gamma$  is Euler's gamma function. Our fitted

ETA and (1 + PT) values are then

$$\widehat{ETA} = \exp(\ln(\widehat{ETA}))F_{\ln(ETA)}$$

$$1 + \widehat{PT} = \exp(\ln(\widehat{1 + PT}))F_{\ln(1+PT)},$$

where  $\ln(\widehat{ETA})$  and  $\ln(\widehat{1 + PT})$  are the first-stage fitted values and  $F_{\ln(ETA)}$  and  $F_{\ln(1+PT)}$  are the Goldberger correction factors corresponding to each equation.

The estimated price multiplier is then converted to an estimated price by multiplying it by a prediction of the base price (that is,  $Price/(1 + PT)$ ) derived from a linear model using data on completed control rides. We then compute a VOT for each session as the ratio of its estimated time and price semi-elasticities, multiplied by the ratio of its estimated price and ETA.

Figure L.1 shows the resulting distribution of VOT estimates. The distribution has a mean of \$22.13/hour and a median of \$20.76/hour, both of which are close to our full-sample estimate of \$19.39/hour. The distribution has a standard deviation of \$10.19 and an inter-quartile range is \$13.47, indicative of the large variability in VOTs between different individuals and contexts.

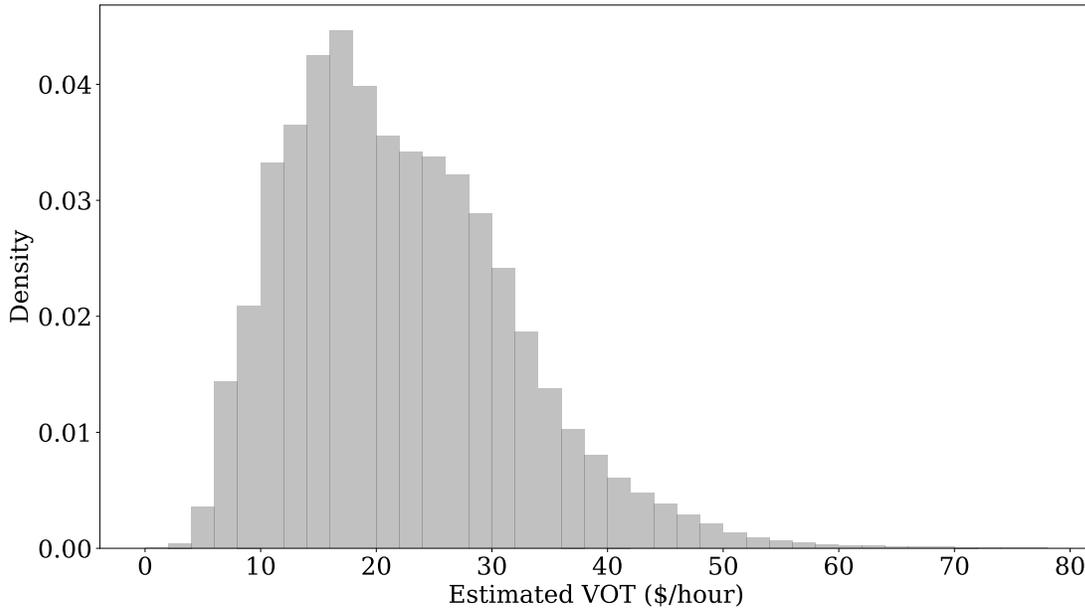


Figure L.1  
Distribution of VOT estimates.

## M Causality with Interaction Effects

In this section, we argue that our IV estimates maintain an [Angrist et al. \(2000\)](#)-type interpretation as causal weighted average derivatives, despite the possibility of cross-session interaction due to marketplace effects.

Let  $\mathbf{Z}$  be the  $N$ -dimensional random vector giving the treatment assignment of every session in the experiment, with distribution function  $F_{\mathbf{Z}}$ . Let  $Z_i$  denote the  $i$ th entry of  $\mathbf{Z}$  and  $\mathbf{Z}_{-i}$  the vector  $\mathbf{Z}$  with the  $i$ th entry deleted. Let  $T_i(\mathbf{Z}) = T_i(Z_i, \mathbf{Z}_{-i})$  be the waiting time of the  $i$ th session; in general, this quantity depends on all of  $\mathbf{Z}$  due to interaction effects. Also let  $D_i(T, \mathbf{Z})$  be the  $i$ th session's demand (conversion rate) when the waiting time is  $T$  and the treatment vector is  $\mathbf{Z}$ .

The following properties hold:

1. *Independence*:  $\mathbf{Z}$  is independent of  $T_i(\mathbf{z})$  and  $D_i(\mathbf{z}) := D_i(T_i(\mathbf{z}), \mathbf{z})$  for all  $i$  and  $\mathbf{z}$ . This property follows because treatment assignments are fully randomized in the experiment.

A consequence is that  $Z_i$  is independent of  $T_i(\mathbf{z}) = T_i(z_i, \mathbf{z}_{-i})$  and  $D_i(\mathbf{z}) = D_i(z_i, \mathbf{z}_{-i})$  for all  $i$  and  $\mathbf{z}$ . It follows that  $T(z) := E[T_i(z, \mathbf{Z}_{-i})] = E[T_i(z, \mathbf{Z}_{-i})|Z_i = z] = E[T_i|Z_i = z]$  and similarly  $D(z) := E[D_i(z, \mathbf{Z}_{-i})] = E[D_i|Z_i = 1]$ .

This result says that we can compute the average waiting time and demand for a session assigned treatment  $z$  by taking averages over all sessions assigned  $z$ . The only difference in our case vs. the no-interaction case is that the average waiting time and demand for a session assigned treatment  $z$  is an average not only over the population of sessions, but also over the possible treatment realizations for all other sessions. Hence, this average may in general depend on the distribution of  $\mathbf{Z}$ ; for example, a distribution that assigns more sessions to a high ETA treatment  $z = 1$  would result in a larger decrease in overall market demand, leaving more supply available and pushing down the average control session ETA  $T(0)$ . To emphasize this dependence on the distribution of  $\mathbf{Z}$ , we might more accurately write the average waiting time and demand for a session assigned treatment  $z$  by  $T(z, F_{\mathbf{Z}})$  and  $D(z, F_{\mathbf{Z}})$ , but suppress this detail in our notation for simplicity.

2. *Exclusion*:  $D_i(T, \mathbf{z}) = D_i(T, \mathbf{z}')$  for all  $i, T, \mathbf{z}$ , and  $\mathbf{z}'$ . This property follows from the design of our experiment: the ETA is the only aspect of the rider's decision to request that is affected by the experiment, and so holding the ETA fixed, the vector of treatment assignments for all sessions does not affect the rider's decision.
3. *Nonzero effect of treatment on ETA*:  $T(z)$  is a nontrivial function of  $z$ . This property is validated empirically by noting that sessions with different ETA treatments have different average ETAs.
4. *Monotonicity*: For all  $z$  and  $z'$ , either  $\Pr\{T(z) \leq T(z')\} = 1$  or  $\Pr\{T(z') \leq T(z)\} = 1$ . If 1 denotes the high ETA treatment, we have  $\Pr\{T(0) \leq T(1)\} = 1$  by design of the experi-

ment: since the high ETA treatment removes nearby drivers from being eligible to pick up a session, it cannot decrease a session’s ETA.

These properties are exactly Assumptions 1–4 of Angrist et al. (2000), from which we conclude that the IV estimand from a regression of  $D_i$  on  $T_i$  using  $Z_i$  as an instrument,

$$\frac{E[D_i|Z_i = 1] - E[D_i|Z_i = 0]}{E[T_i|Z_i = 1] - E[T_i|Z_i = 0]},$$

can be written as

$$\int_0^\infty E \left[ \frac{\partial D_i}{\partial T}(T) \Big| T_i(0) \leq T \leq T_i(1) \right] \omega(T) dT \quad (36)$$

with

$$\omega(T) = \frac{\Pr\{T_i(0) \leq T \leq T_i(1)\}}{\int_0^\infty \Pr\{T_i(0) \leq r \leq T_i(1)\} dr}. \quad (37)$$

This result illustrates that, even without strict SUTVA, our IV estimates can be interpreted as a weighted average of LATE derivatives of demand with respect to ETA. Since  $T(0)$  and  $T(1)$  depend on  $F_Z$ , the presence of interaction effects modify the notion of “local” and the weighting of the derivatives at different points. More concretely, we conclude that under any distribution  $F_Z$  of the treatment assignments satisfying the properties 1–4 above, our IV estimates would have causal interpretations as weighted average derivatives, but the particular choice of  $F_Z$  would affect where on the demand curve these derivatives are evaluated, and how different derivatives at different points on the demand curve are weighted in the final estimate.

## References

- Angrist, J. D., K. Graddy, and G. W. Imbens (2000). The interpretation of instrumental variables estimators in simultaneous equations models with an application to the demand for fish. *The Review of Economic Studies* 67(3), 499–527.
- Federal Highway Administration (2017). National Household Travel Survey.
- Goldberger, A. S. (1968). The interpretation and estimation of Cobb-Douglas functions. *Econometrica* 36(3/4), 464–472.
- Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political Analysis* 20(1), 25–46.
- Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica* 47(1), 153–161.
- Maritz, J. S. and T. Lwin (1989). *Empirical bayes methods*. Routledge.
- Mosimann, J. E. (1962). On the compound multinomial distribution, the multivariate  $\beta$ -distribution, and correlations among proportions. *Biometrika* 49(1/2), 65–82.
- U.S. Bureau of Labor Statistics (2016). May 2016 metropolitan and nonmetropolitan area occupation employment and wages estimates.
- U.S. Bureau of Labor Statistics (2020). Consumer price index for all urban consumers: All items in u.s. city average [cpiaucs].