Uber vs. Taxi: A Driver's Eye View

Online Appendix

Joshua D. Angrist, Sydnee Caldwell, and Jonathan V. Hall

Theoretical Appendix

Rideshare Theory with Alternative Jobs

Recapping notation for the alternative job scenario, the cash required to reach utility $\bar{u}$ is:

- Rideshare: $f^a(w, \bar{u}; t_0, 0) = px^c - w(1-t_0)h^c - e(a^c) = s^a(w(1-t_0), \bar{u}) = s^a(w_0, \bar{u})$
- Taxi: $f^a(w, \bar{u}; 0, L) = (px^c + L) - wh^c - e(a^c) = s^a(w, \bar{u}) + L$,

where again it's understood that compensated demands differ under the two compensation schemes. Replicating the proof of the envelope theorem, we write excess expenditure for a Rideshare driver as

$$s^a(w_0, u_0) = px_0 - w_0h_0 - e(a_0) - \lambda(u(x_0, l_0) - u_0),$$

where λ is the relevant Lagrange multiplier and subscript 0 indicates Rideshare values. Differentiating with respect to after-tax wages, w_0:

$$\begin{aligned} \frac{\partial s^a}{\partial w} &= p\frac{\partial x}{\partial w} - e'(a_0)\frac{\partial a}{\partial w} - h_0 - w_0\frac{\partial h}{\partial w} - \lambda\left[u_x\frac{\partial x}{\partial w} - u_l\left(\frac{\partial a}{\partial w} + \frac{\partial h}{\partial w}\right)\right] \\ &= \frac{\partial x}{\partial w}(p - \lambda u_x) + (\lambda u_l - e'(a_0))\frac{\partial a}{\partial w} - h_0 + (\lambda u_l - w_0)\frac{\partial h}{\partial w} \end{aligned}$$

where we use the fact that $l = T - (a+h)$ and the derivatives are evaluated at Uber parameters. The dual problem's first-order conditions for an interior solution with Rideshare parameters ensure that $\lambda u_l = w(1-t_0) = w_0$ and $p = \lambda u_x$, so we can simplify:

$$\frac{\partial s^a}{\partial w} = (w(1-t_0) - e'(a))\frac{\partial a}{\partial w} - h_0 \tag{1}$$

The scenario we have in mind has positive hours driving for Uber and working on the alternative job, so we also have $w(1-t) = e'(a_0)$. This implies

$$\frac{\partial f^a}{\partial w} = -h_0, \tag{2}$$

as in the model without alternative jobs. Here, however, hours driving differ from total hours worked.

As in the one-job world, Rideshare drivers prefer Taxi when

$$f^a(w, u_0; 0, L) < f^a(w, u_0; t, 0) = s^a(w[1-t], u_0)$$

Using (2):

$$f^a(w, u_0; 0, L) = s^a(w, u_0) + L \approx s^a(w_0, u_0) + L + \frac{\partial s^a}{\partial w}(tw) + \frac{1}{2}\frac{\partial^2 s^a}{\partial w^2}(tw)^2 \qquad (3)$$

$$= L + tw\left(-h_0\right) + \frac{1}{2}\left(-\frac{\partial h_0}{\partial w}\right)(tw)^2$$
$$= L - twh_0 - \frac{1}{2}\left(\frac{\partial h_0}{\partial w}\frac{(1-t)w}{h_0}\right)\frac{t}{1-t}twh_0,$$

where derivatives are evaluated at Rideshare parameters, so Shephard's Lemma produces compensated Rideshare labor supply and its derivative. As before, Rideshare drivers are happy to drive Taxi when:

$$wh_0 > \frac{L}{t}\left(1 + \frac{1}{2(1-t)}\tilde{\delta}t\right)^{-1}$$

This looks like opt-in equation 3 in the main text, but the substitution elasticity here, $\tilde{\delta}$, measures the change in hours driving Rideshare or Taxi, while total labor supply includes hours driving plus hours worked on the alternative job.

Also as before, CV for those who drive Taxi when Rideshare disappears is the difference in the excess expenditure functions evaluated at u_0, the utility obtained when the driver drives for Rideshare:

$$CV = f^a(w, u_0; 0, L) - f^a(w, u_0; t_0, 0)$$

Rearranging (3) yields:

$$CV \approx (L - twh_0) - twh_0\frac{\tilde{\delta}t}{2(1-t)}.$$

This is the standard expression for CV, with $\tilde{\delta}$ replacing δ.

Calibrating Risk Aversion

We calibrate the risk aversion required to justify observed Taxi participation decisions using an argument similar to those in Farber (1978), which estimates the risk aversion implicit in United Mine Worker contracts, and Sydnor (2010), which calibrates the risk aversion required to justify the choice of home insurance deductibles.[1]

We start with approximations for any increasing concave utility function, $u(y)$:

$$E[u(y)] \approx u(E[y]) + \frac{1}{2}u''(E[y])\sigma_y^2$$
$$u(b) \approx u(a) + u'(a)(b-a)$$

Let x denote the Uber farebox and let w denote baseline wealth, assumed to be fixed. Using the first expansion, expected utilities for Taxi and Uber are approximated by

$$E[u(w+x-L)] \approx u(w+E[x]-L) + \frac{1}{2}u''(E[w+x-L])\sigma_x^2 \quad (4)$$
$$E[u(w+[1-t]x] \approx u(w+(1-t)E[x]) + \frac{1}{2}u''(w+(1-t)E[x])(1-t)^2\sigma_x^2 \quad (5)$$

We're interested in the scenario where $E[x] > \frac{L}{t}$ but $E[u(w+(x-L)] < E[u((1-t)x]$, that is, the case where a driver would (in expectation) come out ahead by taking Taxi, but chooses not to do so because Uber has lower expected utility.

We can use the second expansion to approximate utility at mean Taxi earnings around mean Uber utility:

$$u(w+E[x]-L) \approx u(w+(1-t)E[x]) + u'(w+(1-t)E[x])(tE[x]-L)$$

Plugging this into the formulas approximating expected utility under Taxi and Uber, equations (4) and (5), we have:

$$E[u(w+x-L)] - E[w+u((1-t)x] \approx u'(w+(1-t)E[x])(tE[x]-L)$$
$$+\frac{\sigma_x^2}{2}\{u''(w+E[x-L]) - u''(w+(1-t)E[x])(1-t)^2\}$$

Since $u' > 0$, the left hand side here is less than zero when

$$(tE[x]-L) + \frac{\sigma_x^2}{2}\left\{\frac{u''(w+E[x]-L)}{u'(w+E[x]-L)}\phi - \frac{u''(w+(1-t)E[x])}{u'(w+(1-t)E[x])}(1-t)^2\right\} < 0$$

where $\phi = \frac{u'(w+E[x]-L)}{u'(w+(1-t)E[x])} < 1$, since in the scenario of interest, $u'(w+(1-t)E[x]) > u'(w+E[x]-L)$ as we're above breakeven and marginal utility is diminishing. Therefore,

$$\frac{2(tE[x]-L)}{\sigma_x^2} < r[\phi - (1-t)^2]$$

[1]Sydnor (2010) uses simulation to this end; as in Cohen and Einav (2007), our calibration uses a second-order expansion.

where r is the CARA risk aversion parameter. Note that we require $\phi > (1-t)^2$ for this to hold. Equivalently, therefore,

$$r > \frac{2(tE[x] - L)}{\sigma_x^2[\phi - (1-t)^2]}$$

To translate this into a bound on ρ, the coefficient of relative risk aversion, multiply both sides by $E[x(1-t)+w]$, expected wealth in the Uber scenario:

$$rE[w + x(1-t)] = \rho > \frac{2E[w + x(1-t)](tE[x] - L)}{\sigma_x^2[\phi - (1-t)^2]}$$

Finally, note that since we're fixing baseline wealth (this is usually understood to be permanent income), the relevant variance here is just the variance of the Uber farebox.

To bound ρ we use data on weekly fareboxes for 8 weeks in July and August 2016. We first calculate driver-specific farebox means ($E[x]$) and variances (σ_x^2) using these eight weeks of labor supply data (excluding weeks where a driver chose not to drive). We then calculate an individual-specific bound on ρ for all drivers who *should* have accepted a Taxi contract (on the basis of their prior farebox) but chose not to. Setting $\phi \approx 1$ provides an conservative lower bound on ρ.

The table below shows the results of this calibration for different levels of wealth. Specifically, the table shows the average and quartiles of the distribution of calibrated driver-specific ρ. With even low levels of wealth ($5,000), the median driver (among those who would have benefitted from taxi) would have to have a coefficient of risk aversion near 20 in order to rationalize the observed take-up decisions. Note that w denotes *lifetime* wealth. Because the median driver in our sample has a vehicle that was only four years old at the time of the experiment, drivers in our sample likely have current wealth above $5000.[2]

Loss Aversion Around a Rideshare Reference Point

Suppose as in Fehr and Goette (2007) that drivers have a linear utility function with a kink at reference point c:

$$u(x - r) = \begin{cases} \lambda(x - c) & x \geq c \\ \gamma\lambda(x - c) & x < c, \end{cases} \tag{6}$$

where $\gamma > 1$ is a coefficient of loss aversion and c is the reference point. In particular, drivers

[2]Uncertainty about outside wealth is also unlikely to drive the low take-up rates. If we modify the above expression to allow for uncertainty over non-Uber and Uber earnings, we can calibrate the amount of outside uncertainty that is necessary to rationalize the results with reasonable assumptions on driver risk aversion and wealth. Assuming that individuals have lifetime wealth of $5000 and $\rho = 5$ would imply a weekly within-person standard deviation of wealth of roughly 1500. This is implausibly large.

	Bounds on Risk Aversion			
		Quantile		
	Mean	25th	50th	75th
Wealth	(1)	(2)	(3)	(4)
\$0	8.93	0.41	0.97	2.31
\$500	22.08	1.21	2.87	6.50
\$5,000	140.48	8.04	19.92	44.56
\$10,000	272.04	15.83	39.43	87.35
\$20,000	535.14	31.32	78.44	172.48
\$50,000	1324.47	77.71	195.47	428.33
\$100,000	2640.02	155.02	390.52	854.74

are averse to a scenario where Taxi reduces earnings relative to their Rideshare counterfactual.

We simplify further by assuming wages can take on one of two values, w^H, w^L with probabilities $[p, 1-p]$, while labor supply is fixed at $\bar{h}$, so the only choice is whether to drive Rideshare or Taxi. The farebox is therefore $W^H = w^h\bar{h}$ and $W^L = w^L\bar{h}$. Drivers want to avoid money-losing Taxi contracts, so we imagine that

$$\begin{aligned} W_H(1-t) &< W_H - L \\ W_L(1-t) &> W_L - L. \end{aligned}$$

When wages are high, farebox exceeds Taxi breakeven, but not otherwise.

Taking the reference point to be potential Rideshare earnings, Taxi driver utility in each state is

$$\text{high}: \lambda\left[W_H - L - W_H(1-t)\right] = \lambda\left[tW_H - L\right]$$

$$\text{low}: \gamma\lambda\left[W_L - L - W_L(1-t)\right] = \gamma\lambda\left[tW_L - L\right].$$

Although motivated by a variable reference point of the sort discussed by Andersen et al. (2014) and Koszegi and Rabin (2006), this model implies a fixed kink at the earnings level determined by Taxi breakeven.

A driver accepts Taxi if the expected utility from doing so is positive, that is, if

$$p\lambda[tW_H - L] + (1-p)\gamma\lambda[tW_L - L] > 0, \tag{7}$$

since Rideshare utility is normalized to zero. Without loss aversion (i.e., $\gamma = 1$) this simplifies to

$$E[W] = pW_H + (1-p)W_L > L/t.$$

In other words, without loss aversion, linear utility means that drivers accept a Taxi contract when expected earnings exceed the Taxi breakeven. Writing W_L as a fraction π of L/t, the participation rule with loss-aversion simplifies to:

$$E[W] > \frac{L\left(p + (1-p)[\pi + (1-\pi)\gamma]\right)}{t} = \frac{\kappa L}{t}$$

where $\kappa > 1$. Loss aversion therefore acts like a proportional increase in lease costs.

Because loss averse drivers act as if lease costs are κL, we replace L with κL when computing CV. Our empirical results suggest that $\kappa \approx 1.4$. We can use this estimate to calculate the implied coefficient of loss aversion, γ, since κ is a function of loss aversion and the parameters of the Uber-Taxi gamble. This implies:

$$\gamma = \frac{\kappa - p - \pi(1-p)}{(1-\pi)(1-p)}$$

Averaging across the two weeks of Taxi, the probability a driver offered Taxi earned more than breakeven was approximately 53%; this is an estimate of p. Conditional on being below breakeven, the expected loss was 27% of breakeven. This is an estimate of π. These values suggest a coefficient of loss aversion of approximately

$$\gamma = \frac{1.4 - .53 - .27(1 - .53)}{(1 - .27)(1 - .53)} \approx 2.2$$

Empirical Appendix

Randomization Balance

The two Taxi experiments offered contracts to the 1031 drivers who opted in to fee-free driving. One of these drivers left Boston between the first and second Taxi weeks and is therefore omitted from week 2 data. The Taxi experiment randomized offers within the four strata defined by previous hours and fee class. Columns 4 and 5 of tables A3 and A4 show that, conditional on strata, drivers are balanced across Taxi treatments and the control group.

Estimates Without Covariates

Table A7 presents estimates of the ISE from models of the form

$$\log h_{it} = \alpha \log w_{it} + \beta X_{it} + \eta_{it} \tag{8}$$

$$\log w_{it} = \gamma Z_{it} + \lambda X_{it} + \upsilon_{it} \tag{9}$$

where X_{it} includes only dummies for randomization strata. These results are qualitatively similar to the results presented in section 4.2, but the model without covariates produces a wider range of estimates. Results without covariates are also somewhat less precise.

Effects on the Distribution of Hours

Earnings Accelerator participation shifted the entire distribution of hours that treated drivers spent driving. This is clear from Figure A3, which plots estimated cumulative distribution functions (CDFs) for participating drivers' potential hours driven during opt-in week and the Taxi trial. The distribution of potential hours for treated drivers in the treated condition can be written $P[h_{1it} < \nu | D_{it} = 1]$, for a constant ν in the support of the hours distribution. This is an observed quantity. But potential hours for treated drivers in an untreated state, written $P[h_{0it} < \nu | D_{it} = 1]$, are counterfactual. Potential hours distributions are estimated using the methods introduced by Abadie (2002; 2003). Specifically, we estimate models of the following form:

$$
\begin{aligned}
1[h_{it} < v](1 - D_{it}) &= X_i'\beta_0(v) + \alpha_0(v)(1 - D_{it}) + u_{0iv} \\
1[h_{it} < v]D_i &= X_i'\beta_1(v) + \alpha_1(v)D_{it} + u_{1iv},
\end{aligned}
$$

for values of v between 0 and 80, where D_{it} is instrumented with offers, Z_{it}. The parameters $\alpha_0(v)$ and $\alpha_1(v)$ can be shown to describe the CDFs of potential hours for the population of participating drivers, that is, $P[h_{0it} < \nu | D_{it} = 1]$ and $P[h_{1it} < \nu | D_{it} = 1]$.[3]

Figure A3 suggests that the distribution of hours worked among participating drivers first order stochastically dominates their no-participation counterfactual in each of the four weeks in which fees were reduced. Kolmogorov-Smirnov tests reject the null hypothesis of distributional equality between treated and untreated compliers with p-values of .02 or less. Stochastic dominance of this sort weighs against the hypothesis that target earning behavior causes a substantial number of drivers to reduce their hours worked.

Platform Substitution

Our experimental estimates of the intertemporal substitution elasticity may reflect substitution between jobs. A likely substitution opportunity for Uber drivers is driving for Lyft. We assess the relevance of Lyft substitution for labor supply estimates by estimating the ISE for drivers whose car is too old for Lyft or for whom Lyft is likely to be less attractive than Uber. Those with cars from 2003 or earlier are ineligible to work for Lyft while those with cars from 2010 or older are ineligible for key Lyft promotions. The categorical no-Lyft sample is small and was sampled only during Wave 1 of opt-in week. Our investigation of Lyft substitution therefore combines two empirical strategies, one using random assignment to reduced fees and one using a differences-in-differences (DD) approach.

Columns 1-2 of appendix Table A10 report estimates of the ISE computed using randomized assignment to Taxi treatments in the Lyft-ineligible and Lyft-limited groups. In the Taxi experiment, older-car drivers were randomly assigned to treatment or control on the basis of their hours stratum and fee class without further stratification. The estimated ISEs here range from about .9 to 1.3, not very different from those in Table 5, though considerably less

[3] Although $P[h_{1it} < \nu | D_{it} = 1]$ is directly observable, we use the same estimating framework for both h_{1it} and h_{0it} to ensure consistent control for covariates.

precise. Columns 3-4 report the results of adding data on drivers of older cars during the first opt-in week. This enlarged sample increases precision considerably and produces a pair of estimates in line with those in Table 5.

Our DD strategy combines data from Wave 1 of opt-in week and the week prior to opt-in week, pooling all Wave 2 drivers with the subset of Wave 1 drivers who drive an old car. Wave 2 drivers provide an opt-in week control group for the Lyft-ineligible/limited subset of Wave 1, while the week prior to opt-in week captures any time-invariant differences between Lyft-ineligible/limited drivers and a random sample. In particular, the DD strategy uses this sample to estimate a model that can be written

$$\begin{aligned} \ln h_{it} &= \delta \ln w_{it} + \beta_0 live_t + \beta_1 d_i + \epsilon_{it} \\ \ln w_{it} &= \phi(d_i * live_t) + \alpha_0 live_t + \alpha_1 d_i + \eta_{it}, \end{aligned}$$

where the variable $live_t$ indicates data from the first opt-in week when Wave 1 drivers drove fee-free and d_i indicates Wave 1 drivers. The parameter ϕ is the DD estimate of the first stage effect of being a Wave 1 driver during opt-in week. Columns 5 of Table A10 reports the resulting 2SLS estimate of δ pooling hours groups. At 1.32, this estimate is also similar to the ISE estimates reported in Table 5, though again not as precise.

Standard Errors for Participation Analysis

Bootstrap standard errors for the estimates reported in Tables 7 were computed as follows:

1. Draw bootstrap samples of treated and control drivers, stratifying on commission, fee class, and week.

2. Use the control drivers to fit models of the form

   $$E[\ln y_{0i}|L_i, t_i, X_i] = E[\ln wh_0|L_i, t_i, X_i] = X_i'\beta$$

   where X_i includes the sets of covariates discussed in the text.

3. Construct the regressor

   $$\hat{w}_i = \hat{\sigma}(t_i) + X_i'\hat{\beta} - \ln \frac{L_i}{t_i}$$

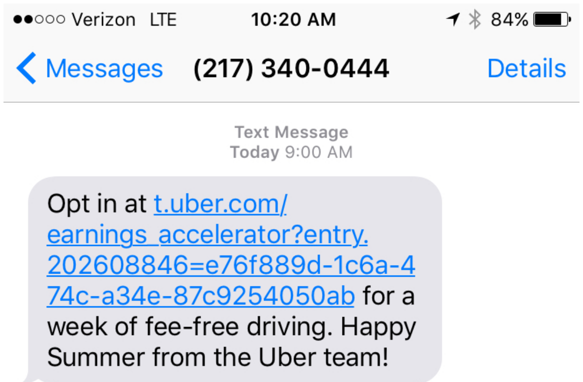
   for treated drivers using $\hat{\beta}$ calculated in step 2, and an intertemporal substitution elasticity of 1.8. Recall that $\sigma(t_i)$ is the proportional participation threshold reduction due to higher Taxi wages.

4. Estimate a Probit model for Taxi participation decisions in the treated sample as a function of $\hat{w}_i$ and a constant

5. The bootstrap standard error is the standard deviation of the estimates of the parameters of interest in 500 bootstrap replications

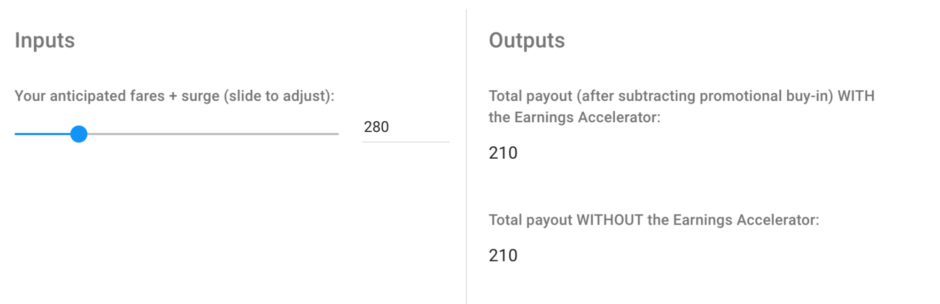
Tables and Figures

Figure A1: Taxi Messaging



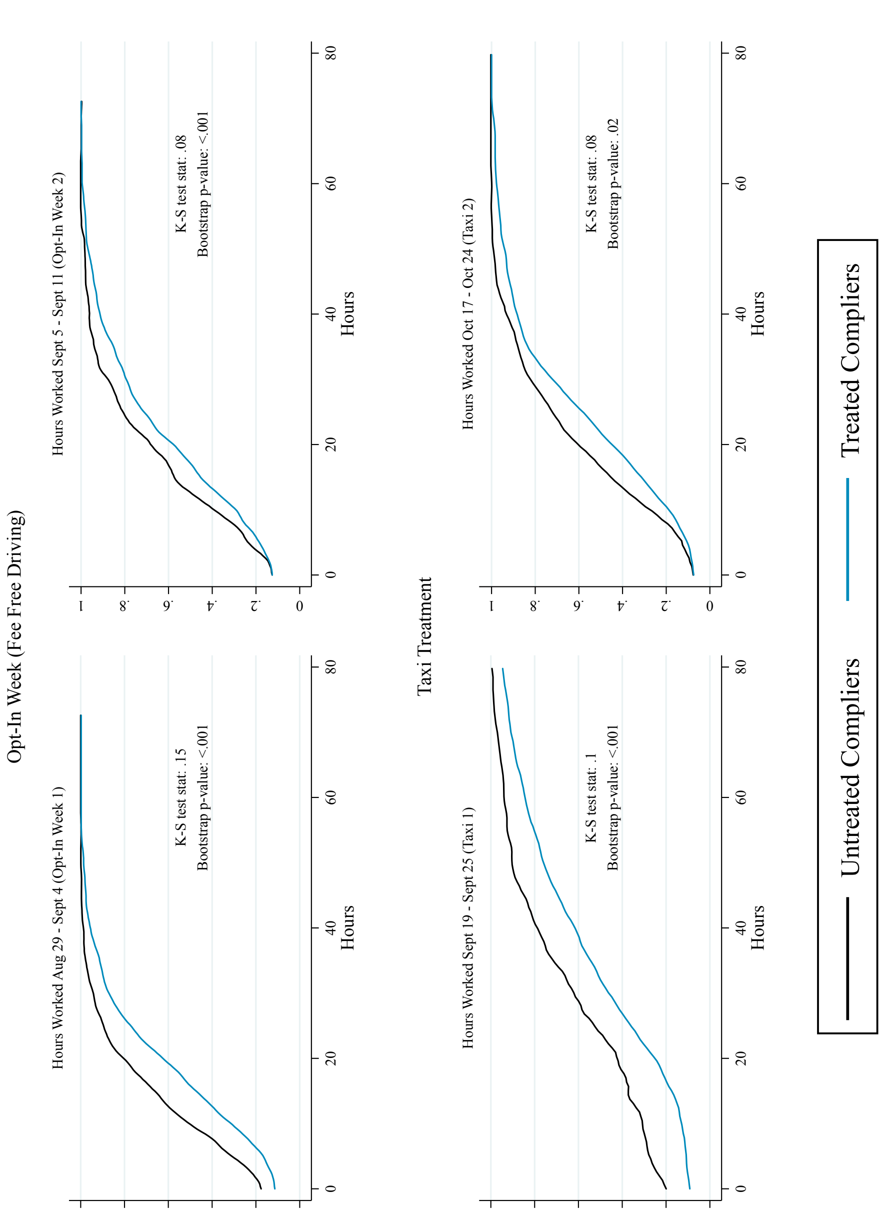
Note: This shows an example of how drivers received the offers via text. Each text would lead them to a Google Form, pre-filled with their unique driver ID, which provided them with more information on their offer. They received the same link via e-mail and through the driver app.

Figure A2: Taxi Slider



Note: This is a picture of one of the sliders sent to drivers who were offered a Taxi contract. Each slider was programmed to load at the breakeven point. Drivers could either slide the slider at the left or type in a number for their anticipated fares+surge to the right of the slider.

Figure A3: Distribution Treatment Effects



Note: These figures report estimated CDFs of potential hours driven in treated and non-treated states for drivers who participated in the Earnings Accelerator. Top panels show estimates for drivers who accepted the opportunity to drive fee-free during the opt-in week. Bottom panels show estimates for drivers who bought a Taxi lease. CDFs are estimated by instrumenting participation with experimental offers as described in the text, using a grid of 200 points. CDFS are smoothed using a 5 point moving average. Models control for the strata used for random assignment.

Table A1: Experimental Timeline

Week Beginning	Action
August 22	Wave 1 Notifications and Opt-In
August 29	Wave 1 Opt-Ins Drive Fee-Free; Wave 2 Notifications and Opt-In
September 5	Wave 2 Opt-Ins Drive Fee-Free
September 12	Taxi 1 Offers and Opt-In
September 19	Taxi 1 Live
September 26	
October 3	
October 10	Taxi 2 Offers and Opt-In
October 17	Taxi 2 Live

Note: This table shows the timeline of the Earnings Accelerator Experiment, which was conducted in 2016.

Table A2: Covariate Balance for Wave 1 and Wave 2

	Wave 1 Mean (1)	Strata-Adjusted Difference (2)
Female	0.14	0.02
		(0.02)
Hours Week Starting 08/08	16.23	-0.62
		(0.54)
Average Hours/Week the Month Before Selection	14.56	-0.03
		(0.15)
Earnings/Hour Week Starting 08/08	17.64	-0.37
		(0.43)
Average Earnings/Hour the Month Before Selection	17.14	0.28
		(0.31)
Months Since Signup	10.70	0.01
		(0.25)
Vehicle Solutions	0.07	0.00
		(0.02)
F-statistic		0.79
p-value		0.59
Number of Observations	800	1600

Note: Column 1 reports covariate means for drivers offered fee-free driving in the first opt-in week. Column 2 reports the strata-adjusted difference in means between drivers offered fee-free driving in week 1 and week 2. Robust standard errors are reported in parentheses. Earnings are net of the Uber fee. Levels of significance: *10%, ** 5%, and *** 1%.

Table A3: Covariate Balance for Taxi 1

	Control Mean (1)	T=0 Treated Mean (2)	T=.125 Treated Mean (3)	T=0-Control Difference (4)	T=125-Control Difference (5)
Female	0.16	0.16	0.14	0.00	-0.02
	[0.37]	[0.36]	[0.34]	(0.03)	(0.03)
Hours Week Starting 08/08	12.08	13.64	13.98	1.55**	1.88**
	[9.91]	[9.60]	[11.22]	(0.61)	(0.84)
Average Hours/Week in 4 Weeks Preceeding Selection	14.53	14.81	14.80	0.27	0.25
	[5.66]	[5.71]	[5.69]	(0.20)	(0.24)
Average Hourly Earnings Week Starting 08/08	16.59	17.23	16.60	0.63	0.01
	[10.25]	[9.06]	[9.91]	(0.65)	(0.84)
Average Hourly Earnings in 4 Weeks Preceeding Selection	17.86	18.40	17.82	0.54	-0.05
	[6.16]	[6.01]	[6.69]	(0.40)	(0.53)
Months Since Signup	11.05	10.82	10.67	-0.21	-0.34
	[8.61]	[8.24]	[8.58]	(0.32)	(0.41)
Vehicle Solutions	0.08	0.10	0.10	0.03	0.02
	[0.27]	[0.31]	[0.30]	(0.02)	(0.02)
Farebox Week Starting 08/22	348.28	356.50	347.56	8.08	-1.20
	[309.29]	[312.33]	[308.88]	(21.04)	(25.05)
Hours Worked Week Starting 08/22	15.31	15.15	15.54	-0.17	0.21
	[13.13]	[12.69]	[13.70]	(0.87)	(1.10)
Car Model Year 2003 or Older	0.11	0.13	0.12	0.02	0.01
	[0.32]	[0.34]	[0.33]	(0.02)	(0.03)
Car Model Year 2011 or Newer	0.58	0.57	0.55	-0.01	-0.03
	[0.49]	[0.50]	[0.50]	(0.03)	(0.04)
F-statistic				1.34	1.09
p-value				0.20	0.37
Number of Observations	412	413	206	825	618

Note: The 1031 drivers who opted in were randomly assigned within 4 strata defined by hours (high/low) and commission (20/25% commission). Columns 1-3 report sample means for the control group and the two treatment groups. Columns 4 and 5 report the strata-adjusted difference between the means in each treatment group and the control group. Robust standard errors are reported in parentheses. Average hourly earnings include surge but are net of fee. Vehicle solutions drivers lease a car through an Uber-sponsored leasing program. Levels of significance: *10%, ** 5%, and *** 1%.

Table A4: Covariate Balance for Taxi 2

	Control Mean (1)	T=0 Treated Mean (2)	Half Fee Treated Mean (3)	T=0-Control Difference (4)	Half Fee-Control Difference (5)
Female	0.15	0.15	0.17	0.00	0.02
	[0.35]	[0.36]	[0.38]	(0.03)	(0.03)
Hours Week Starting 08/08	13.17	12.97	13.12	-0.18	-0.03
	[10.23]	[10.16]	[9.85]	(0.69)	(0.69)
Average Hours/Week in 4 Weeks Preceeding Selection	14.76	14.59	14.73	-0.16	-0.02
	[5.65]	[5.75]	[5.69]	(0.21)	(0.22)
Average Hourly Earnings Week Starting 08/08	16.83	16.60	17.18	-0.22	0.37
	[10.61]	[9.23]	[8.91]	(0.73)	(0.71)
Average Hourly Earnings in 4 Weeks Preceeding Selection	18.22	17.93	18.04	-0.27	-0.16
	[6.70]	[5.94]	[5.80]	(0.44)	(0.44)
Months Since Signup	11.15	10.53	10.88	-0.56*	-0.21
	[8.53]	[7.94]	[8.86]	(0.34)	(0.36)
Vehicle Solutions	0.08	0.10	0.10	0.01	0.02
	[0.28]	[0.30]	[0.30]	(0.02)	(0.02)
Farebox Week Starting 08/22	380.55	359.41	394.31	-20.39	14.39
	[393.81]	[399.72]	[387.84]	(28.67)	(28.63)
Hours Worked Week Starting 08/22	12.94	12.52	14.09	-0.40	1.17
	[12.95]	[13.50]	[13.45]	(0.97)	(0.97)
Car Model Year 2003 or Older	0.12	0.13	0.12	0.01	0.01
	[0.32]	[0.33]	[0.33]	(0.02)	(0.02)
Car Model Year 2011 or Newer	0.59	0.56	0.55	-0.03	-0.04
	[0.49]	[0.50]	[0.50]	(0.04)	(0.04)
Treated During Week 1	0.59	0.63	0.59	0.04	0.00
	[0.49]	[0.48]	[0.49]	(0.04)	(0.04)
F-statistic				0.58	1.15
p-value				0.86	0.32
Number of Observations	410	310	310	720	720

Note: All but one of the 1031 drivers who accepted the opt-in week promotion were randomly assigned within the 4 strata defined by hours (high/low) and commission (20/25%). The excluded driver left Boston. Columns 1-3 report sample means for the control group and the two treatment groups. Columns 4 and 5 report the strata-adjusted difference between the means in each treatment group and the control group. Robust standard errors are reported in parentheses. Average hourly earnings include surge but are net of fee. Vehicle solutions drivers lease a car through an Uber-sponsored leasing program. Levels of significance: *10%, ** 5%, and *** 1%.

Table A5: Participation 2SLS, Additional Labor Supply Estimates

	Opt-In Week						Taxi					
	Pooled		High Hours		Low Hours		Pooled		High Hours		Low Hours	
	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A. Strata Only												
Active (wh>0)	0.77	0.04***	0.85	0.03**	0.69	0.04*	0.74	0.05	0.80	-0.02	0.68	0.13**
		(0.01)		(0.02)		(0.02)		(0.04)		(0.06)		(0.06)
		3200		1600		1600		2061		1058		1003
Log Hours	2.58	0.32***	2.78	0.32***	2.33	0.33***	2.58	0.33***	2.68	0.42***	2.45	0.23**
		(0.03)		(0.04)		(0.05)		(0.08)		(0.11)		(0.11)
		2485		1367		1118		1544		836		708
Log Earnings	5.74	0.34***	5.96	0.32***	5.47	0.37***	5.86	0.29***	5.96	0.37***	5.73	0.20*
		(0.04)		(0.05)		(0.06)		(0.09)		(0.13)		(0.12)
		2485		1367		1118		1544		836		708
B. Strata and Covariates												
Active (wh>0)	0.77	0.05***	0.85	0.04**	0.69	0.06***	0.74	0.01	0.80	-0.04	0.68	0.07*
		(0.01)		(0.02)		(0.02)		(0.02)		(0.03)		(0.03)
		2472		1336		1136		1561		840		721
Log Hours	2.58	0.32***	2.78	0.30***	2.33	0.34***	2.58	0.40***	2.68	0.43***	2.45	0.34***
		(0.03)		(0.04)		(0.05)		(0.07)		(0.10)		(0.09)
		2214		1242		972		1422		775		647
Log Earnings	5.74	0.33***	5.96	0.30***	5.47	0.36***	5.86	0.39***	5.96	0.40***	5.73	0.34***
		(0.04)		(0.04)		(0.06)		(0.07)		(0.10)		(0.10)
		2214		1242		972		1422		775		647

Note: This table reports 2SLS estimates of effects on labor supply. The endogenous variable is participation, instrumented with treatment offers. Models controls for the strata used for random assignment and for time dummies. Models with covariates contain additional controls for gender, months driving for Uber, car age (2003 or newer), and one lag of log earnings. Standard errors are clustered by driver. The number of observations contributing to each estimate appears beneath the standard error. Levels of significance: *10%, ** 5%, and *** 1%.

Table A6: Participation 2SLS, Estimates for Other Outcomes

	Opt-In Week						Taxi					
	Pooled		High Hours		Low Hours		Pooled		High Hours		Low Hours	
	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Completed Trips	29.53	12.48***	37.69	14.38***	21.38	10.48***	30.93	12.11***	35.97	14.22***	25.62	10.17***
		(1.00)		(1.50)		(1.30)		(3.13)		(4.95)		(3.82)
		3200		1600		1600		2061		1058		1003
Number of Days Worked	3.47	0.69***	4.13	0.64***	2.80	0.74***	3.36	0.73***	3.71	0.72**	3.00	0.76**
		(0.08)		(0.11)		(0.12)		(0.24)		(0.37)		(0.32)
		3200		1600		1600		2061		1058		1003
Hourly Farebox	24.64	0.33	24.88	-0.20	24.33	0.95**	27.69	-0.72	27.78	-1.20	27.57	-0.42
		(0.25)		(0.28)		(0.42)		(0.72)		(1.07)		(0.92)
		2485		1367		1118		1544		836		708
Proportion Trips on Surge	0.19	-0.01	0.19	-0.01	0.18	0.00	0.26	-0.01	0.25	0.00	0.28	-0.03
		(0.01)		(0.01)		(0.01)		(0.02)		(0.03)		(0.02)
		2485		1367		1118		1544		836		708
Average Rating	4.79	-0.01	4.79	-0.01	4.78	-0.01	4.81	-0.01	4.81	-0.01	4.81	-0.01
		(0.01)		(0.01)		(0.02)		(0.02)		(0.03)		(0.03)
		2474		1362		1112		1536		832		704
Proportion Rated	0.79	0.00	0.78	0.00	0.79	0.00	0.78	0.00	0.78	0.01	0.79	0.00
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)
		2474		1362		1112		1536		832		704

hahah

Note: This table reports 2SLS estimates of effects on other outcomes. The endogenous variable is participation in fee-free driving or Taxi, instrumented with treatment offers. Models controls for the strata used for random assignment and for time dummies. Standard errors are clustered by driver. The number of observations in each regression appears beneath the standard error. Levels of significance: *10%, ** 5%, and *** 1%.

Table A7: ISE Estimates from Models Without Covariates

	Opt-In Week			Taxi		
	Pooled	High Hours	Low Hours	Pooled	High Hours	Low Hours
	(1)	(2)	(3)	(4)	(5)	(6)
			A. 2SLS Estimates			
First Stage	0.20***	0.19***	0.22***	0.11***	0.10***	0.13***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
2SLS	1.13***	1.19***	1.06***	1.68***	2.22***	1.14**
	(0.12)	(0.17)	(0.18)	(0.46)	(0.76)	(0.58)
Over-identified	1.14***	1.19***	1.09***	1.39***	1.73***	1.06**
Model	(0.12)	(0.17)	(0.18)	(0.29)	(0.41)	(0.42)
			B. OLS Estimates			
OLS	0.37***	0.38***	0.35***	0.38***	0.33***	0.45***
	(0.06)	(0.09)	(0.09)	(0.09)	(0.10)	(0.15)
Drivers	1344	721	623	864	462	402
Observations	2485	1367	1118	1544	836	708

Note: This table reports 2SLS estimates of the ISE. The endogenous variable is log wages, instrumented with treatment offers. The over-identified model in columns 1-3 uses separate treatment indicators for each week, fee class, and hours group. The over-identified model in columns 4-6 uses separate treatment indicators for each taxi offer. Models control for the strata used for random assignment and time dummies. Standard errors are clustered by driver. A total of 1600 drivers were offered fee-free driving in opt-in week; 1031 accepted the offer and were eligible for Taxi leasing. Sample sizes in columns 1 and 4 are lower because the data used to construct this table omit zeros. Levels of significance: *10%, ** 5%, and *** 1%.

Table A8: Taxi Take-Up by Subgroup

	By Commission		By Hours Group		By Taxi Week	
	20%	25%	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Slope	0.64***	0.77***	0.76***	0.65***	0.58***	0.97***
	(0.14)	(0.11)	(0.13)	(0.15)	(0.11)	(0.18)
Intercept	-0.18*	-0.28***	-0.29***	-0.17	-0.22***	-0.41**
	(0.10)	(0.09)	(0.08)	(0.14)	(0.08)	(0.16)
Implied Kappa	1.32***	1.43***	1.45***	1.29***	1.45***	1.52***
	(0.18)	(0.13)	(0.13)	(0.23)	(0.18)	(0.16)
Implied Tau	1.57***	1.30***	1.31***	1.53***	1.71***	1.03***
	(0.33)	(0.19)	(0.23)	(0.35)	(0.32)	(0.18)
Forecasting regression RMSE	0.70	0.89	0.79	0.87	0.81	0.83
Number of Drivers	356	582	500	438	486	452

Notes: Parametric models are fit to micro data on take-up using equation 18 in the text. Standard errors are bootstrapped as described in the appendix. Each column uses data from the control drivers' earnings distribution. Levels of significance: *10%, ** 5%, and *** 1%.

Table A9: Compensating Variation with UI

	Weekly Lease Rates						
	$50	$100	$150	$200	$400	$600	$800
Wage Gap	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	A. Nominal Lease						
	-$44	-$5	$27	$53	$124	$159	$175
15%	17%	31%	43%	53%	77%	89%	96%
	-2.4%	-8%	-14%	-21%	-51%	-73%	-87%
	-$78	-$39	-$6	$23	$99	$139	$159
20%	15%	29%	41%	50%	75%	87%	94%
	-2.1%	-7%	-13%	-19%	-47%	-69%	-84%
	-$116	-$75	-$41	-$12	$71	$117	$142
25%	14%	28%	39%	48%	72%	85%	93%
	-1.9%	-6%	-11%	-17%	-43%	-65%	-80%
	-$385	-$341	-$301	-$264	-$147	-$65	-$7
50%	8%	18%	27%	34%	56%	71%	80%
	-0.8%	-2.8%	-6%	-9%	-25%	-41%	-56%
	B. Behavioral Lease						
	-$27	$21	$58	$88	$154	$177	$183
15%	23%	41%	54%	65%	88%	97%	99%
	-4%	-13%	-23%	-33%	-69%	-89%	-97%
	-$61	-$12	$28	$59	$133	$162	$171
20%	21%	39%	52%	62%	86%	95%	99%
	-4%	-11%	-21%	-31%	-65%	-86%	-96%
	-$99	-$48	-$6	$27	$110	$145	$158
25%	20%	37%	49%	59%	83%	94%	98%
	-3%	-10%	-19%	-28%	-61%	-83%	-94%
	-$367	-$308	-$257	-$212	-$79	$3	$52
50%	13%	25%	35%	44%	68%	82%	90.1%
	-2%	-5%	-9%	-15%	-38%	-58%	-74%

Notes: Panel A shows compensating variation (CV, paid to Rideshare drivers to induce them to work under Taxi), computed for the nominal lease rates listed in columns 1-7. Panel B evaluates CV using behavioral lease rates computed from Taxi take-up. The behavioral lease is fifty percent greater than the nominal lease. The ISE is set at 1.2. The first row of each cell shows average CV. The second row reports the percent of drivers on UI and the third reports the percent change in aggregate hours supplied, relative to a scenario without UI. CV is evaluated using weekly earnings and hours data for all Boston Uber drivers who completed at least 4 trips in July 2016. Weeks with zero trips are omitted. The mean farebox conditional on driving is 541. The mean payout conditional on driving is 423.

Table A10: No-Lyft and Low-Lyft Uber ISEs

	Taxi		Taxi + Wave 1		DD (Opt-in Waves)
		2010-	2003-	2010-	2003-
	(1)	(2)	(3)	(4)	(5)
First Stage	0.11**	0.11***	0.10*	0.17***	0.23***
	(0.05)	(0.03)	(0.05)	(0.02)	(0.03)
2SLS	0.88	1.30*	1.00	1.13***	1.32***
	(1.20)	(0.68)	(1.28)	(0.32)	(0.37)
OLS	0.52**	0.29**	0.25	0.24**	0.06
	(0.23)	(0.14)	(0.16)	(0.10)	(0.09)
Number of Observations	101	363	158	571	839
Number of Drivers	174	633	328	1181	1538

Note: This table reports 2SLS estimates of the ISE for drivers with cars older than 2003 and 2010. The first group cannot drive for Lyft; the second receives limited Lyft promotions. The row labeled OLS reports estimates from a regression of log hours on log wages. The row labeled 2SLS reports IV estimates generated by instrumenting wages. ISE estimates in columns 1-4 use random assignment of older-car drivers during Taxi weeks and the first opt-in week. Column 5 reports difference-in-differences estimates of the ISE using data from the first opt-in week and the week prior, pooling all Wave 2 drivers with the subset of Wave 1 drivers who drive an old car, and instrumenting with a dummy for being treated during opt-in week. Standard errors are clustered by driver. All specifications control for hours bandwidth, commission, and time dummies. . Levels of significance: *10%, ** 5%, and *** 1%.

References

Abadie, Alberto, "Bootstrap Tests for Distributional Treatment Effects in Instrumental Variable Models," *Journal of the American Statistical Association*, March 2002, *97* (457), 284–292.

_ , "Semiparametric Instrumental Variable Estimation of Treatment Response Models," *Journal of Econometrics*, April 2003, *113* (2), 231–263.

Andersen, Steffen, Alec Brandon, Uri Gneezy, and John A List, "Toward An Understanding of Reference-Dependent Labor Supply: Theory and Evidence From A Field Experiment," Working Paper 20695, National Bureau of Economic Research November 2014.

Cohen, Alma and Liran Einav, "Estimating Risk Preferences From Deductible Choice," *The American Economic Review*, June 2007, *97* (3), 745–788.

Farber, Henry S, "Individual Preferences and Union Wage Determination: The Case of the United Mine Workers," *Journal of Political Economy*, October 1978, *86* (5), 923–942.

Fehr, Ernst and Lorenz Goette, "Do Workers Work More if Wages are High? Evidence from a Randomized Field Experiment," *The American Economic Review*, March 2007, *97* (1), 298–317.

Koszegi, Botond and Matthew Rabin, "A Model of Reference-Dependent Preferences," *The Quarterly Journal of Economics*, November 2006, *121* (4), 1133–1165.

Sydnor, Justin, "(Over)insuring Modest Risks," *American Economic Journal: Applied Economics*, October 2010, *2* (4), 177–199.