8220 Empirical Problem Set One Solutions

1. Estimating a Simple Entry Model

   (a) Produce and present summary statistics.

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Population	449	12030.98	14269	4019	176576
Housing	449	22152.51	19910.49	989	132640
Auto Route	449	.2806236	.4498051	0	1

Table 1: Summary Statistics

   (b) The Histograms of Firm Frequencies:

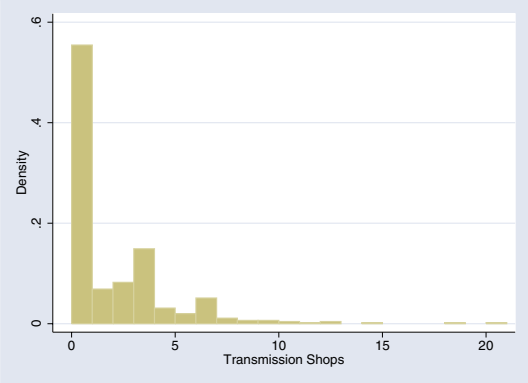

Figure 1: Histogram of Number of Transmission Repair Shops

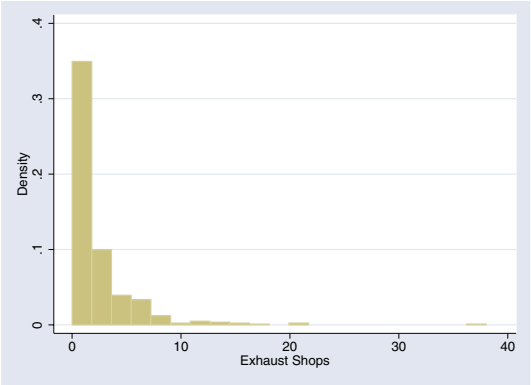

Figure 2: Histogram of Number of Exhaust Repair Shops

Variable	**Coefficient** (Std. Err.)
Population	0.00005** (0.00001)
Housing	0.00004** (0.00001)
Auto Route	0.38469 (0.24868)
Intercept	-0.03592 (0.17972)
N	449
R^2	0.25033
$F_{(3,445)}$	49.53186

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Table 2: OLS on Number of Transmission Shops

Variable	**Coefficient** (Std. Err.)
Population	0.00011** (0.00001)
Housing	0.00004** (0.00001)
Auto Route	0.27991 (0.31897)
Intercept	-0.41672† (0.23052)
N	449
R^2	0.31784
$F_{(3,445)}$	69.11206

Significance levels : † : 10% * : 5% ** : 1%

Table 3: OLS on Number of Exhaust Shops

The correlation coefficient between the residuals is 0.4853.

(c) The likelihood can be broken up into three parts, cases in which the number of firms is zero, between 1 and 4 inclusive, and greater than or equal to five.

i. $N = 0$
This is implied by the event that no firms found it profitable to enter.

$$\Pi(1, x_m) + \epsilon_m < 0 \tag{1}$$

The probability of this event is

$$\Phi(-\pi(1, x_m)) \tag{2}$$

where Φ is the cumulative distribution function of a standard normal random variable.

ii. $1 \leq N < 5$
This is implied by the event that firm N found it profitable to enter, but firm $N + 1$ did not.

The probability of this event is:

$$\Phi(-\pi(N+1, x_m)) - \Phi(-\pi(N, x_m)) \tag{3}$$

Note the importance of our assumption that the firms are symmetric and that the profit function is decreasing in N.

iii. $N \geq 5$
This is the residual event, and the probability that it occurs is:

$$1 - \Phi(-\pi(5, x_m)) \tag{4}$$

The likelihood is given by:

$$L(\beta) = \prod_{m=1}^{M} (\Phi(-\pi(1, x_m)))^{1(N_m=0)} \tag{5}$$

$$(\Phi(-\pi(N_m+1, x_m)) - \Phi(-\pi(N_m, x_m)))^{1(0<N_m<5)} \tag{6}$$

$$(1 - \Phi(-\pi(5, x_m)))^{1(N_m>4)} \tag{7}$$

(d) See attached matlab code for implementation.

Table 4: MLE Point Estimates For Bresnahan/Reiss Problem

Coefficient	
$\beta_{logpopulation}$	0.73877
α_1	-6.8547
α_2	-0.20061
α_3	-0.26035
α_4	-0.59579
α_5	-0.17049
Log-Likelihood	-568.7292