Econometrics Problem Set 5

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Question 1: Chernozhukov et al (2015)

By censoring, we see that the effect of expenditure on alcohol consumption is much more pronounced, than without censoring. In this way, households that do not purchase alcohol are not included in the analysis; thus avoiding biasing the coefficient estimates downwards.

```
Quantile IV regression (uncensored)                    Number of obs =      1655
Endogenous variable = logexp
Instrument(s) = logwages nkids
First stage estimation = quantile regression
Weighted bootstrap(10) confidence intervals            Level (%)     =        95
```

alcohol	25	50	75
logexp			
_b	.0401086	.1346318	.1254976
mean	.0517212	.1628565	.084136
lower	.0229566	.1042195	-.1872512
upper	.1241916	.2183429	.4369495
logexp2			
_b	-.0029476	-.011193	-.0113
mean	-.0038306	-.0135181	-.007601
lower	-.010249	-.0186806	-.0394653
upper	-.0013758	-.0084022	.0154976
nkids			
_b	-.0066548	-.0136839	-.033145
mean	-.0066994	-.0178548	-.0383522
lower	-.0088402	-.026406	-.048844
upper	-.0031931	-.0118195	-.0266865
_cons			
_b	-.1182446	-.3608853	-.2539255
mean	-.1536844	-.4371881	-.1371894
lower	-.3476746	-.5857071	-1.108983
upper	-.0749172	-.2799253	.6731477
ehat			
_b	.0099471	.0183555	.0319904
mean	.0100943	.0094097	.0393337
lower	-.0040624	-.0056555	.0102596
upper	.0195748	.0206369	.0665737

Figure 1: Uncensored output statistics

```
Censored quantile IV regression                              Number of obs =      1655
Censoring point =      0
Endogenous variable = logexp
Instrument(s) = logwages nkids
First stage estimation = quantile regression
Weighted bootstrap(10) confidence intervals                  Level (%)     =        95
```

alcohol	25	50	75
logexp			
_b	.3216247	.2463935	.0946595
mean	.3284591	.3840601	.160221
lower	.0298652	.101788	-.2191503
upper	.6011192	.8430048	.8970088
logexp2			
_b	-.0282586	-.0213251	-.0087811
mean	-.0286405	-.0335717	-.0147132
lower	-.0539386	-.0754104	-.0822622
upper	-.0015171	-.0076445	.0187026
nkids			
_b	-.0097902	-.0161236	-.0344429
mean	-.0108346	-.0220546	-.0387873
lower	-.0169723	-.0277458	-.0506933
upper	-.0045927	-.0160467	-.0290805
_cons			
_b	-.8877962	-.6626081	-.1591261
mean	-.9119706	-1.035604	-.3379363
lower	-1.633326	-2.277361	-2.320282
upper	-.102954	-.2786761	.7495545
ehat			
_b	-.003214	.0123775	.0305732
mean	-.0020835	.000129	.0355202
lower	-.0232633	-.0224354	-.0095712
upper	.0153978	.0221342	.0657327

Figure 2: Censored output statistics

Question 2

Consider the random variables $t_1, \dots, t_n$ that are independent and follow an exponential distribution $f(t, \lambda)$ with a parameter λ. Solve for the MLE estimator of λ in a closed form.

To find the likelihood function, we can use

$$\mathcal{L}(\lambda | t_1, \cdots, t_n) = \prod_{i=1}^{n} f(y_i) = \lambda e^{-\lambda y_1} \lambda e^{-\lambda y_2} \cdots \lambda e^{-\lambda y_l} = \lambda^n e^{-\lambda} \sum_{i=1}^{n} y_l$$

If we take the log of the likelihood function:

$$l = ln(L(\lambda | y_1, y_2, \cdots, y_n)) = nln\lambda - \lambda \sum_{i=1}^{n} y_i = 0$$

Taking the FOC wrt λ we get:

$$\frac{\partial l}{\partial \lambda} = (nln\lambda - \lambda \sum_{i=1}^{n} y_i) = \frac{n}{\lambda} - \sum_{i=1}^{n} y_i = 0$$

Which gives us our final result of

$$\lambda = \frac{n}{\sum_{i=1}^{n} y_i}$$